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AN OBLIQUE EQUAL AREA MAP FOR WORLD DISTRIBUTIONS

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SEVERAL conclusions stand out from the mass of what has been written about the advantages and disadvantages of various projections. The conclusions may be paraphrased quite simply. There is no perfect all-purpose map. A projection should be selected with a given purpose in mind. At best, the selection will be the most useful compromise from the wide range of alternatives.

After the conclusions have been stated, there then follows, in most texts upon this subject, a discussion or a listing of the characteristics of the better-known projections. The selector of a base map is then commended to these specifications for the frustrating task of matching his requirements with the known alternatives.

Depending upon the insight of the map maker into his problem the matching process may or may not result in a wise choice. The awareness of the advantages and limitations of different projections should, of course, include more than mere technical specifications, important as they are. It is far more significant that the design or selection of a base map upon which to plot distributions for geographical analysis should be the outgrowth of specific concepts of geography.

The larger the amount of the earth's surface to be represented, of course, the more difficult is it to minimize and control the distortions resulting from transformation of a spherical surface onto a plane. For this reason maps of the entire earth pose the greatest challenge to the map maker.

It is the purpose of this paper to unite the threads of thought in the last two paragraphs through the presentation and illustration of a particular oblique equal-area map for world distributions. The discussion is divided into four parts: 1) a conceptual basis for oblique versus equatorial cases of world grids, 2) a brief description of the particular base map under consideration, 3) a visual comparison of its angular deformation with that of two equatorial grids and one other oblique case, and 4) the illustration of its usefulness as demonstrated by four world patterns, two each from physical and human geography.

CONCEPTUAL BASIS FOR OBLIQUE VERSUS EQUATORIAL CASES

Isolating component parts of the complex of things which comprise the human occupance of an area is one of the principal problems of geographical analysis. The geographer cannot actually separate physically the parts of his subject for study and comparison. He must visualize them, one at a time or in combinations, by means of the map. The map, therefore serves two basic purposes. It reduces the scale of what is to be examined to manageable proportions and it serves as a visual means of isolating the variables in a complex series of elements of the human occupance of the earth.

The base map, however, is more than a depository for the material to be examined. It supplies selected optimum conditions for analysis and comparison which may be thought of as constants. Common examples are the equal-area property of equivalent projections, the true-directional characteristic for straight lines on a Mercator, or the ability to draw great circles as straight lines on a gnomonic projection. Need for one or another of these constants in the course of the examination of particular data will obviously narrow down the selection of a projection for a particular purpose.

It is often forgotten, however, that every base map presents inherently certain variable phenomena with which any data mapped thereon will be shown in mutual relationship. Two such inherent variables will be discussed. Parallels of latitude are equal sun-behaviour lines.[1] Every world grid is, therefore, both a base for the recording of other phenomena and at the same time a map showing the distribution of world insolation. Again, the extremely uneven distribution of the world's lands is another highly significant variable with which phenomena plotted on base maps are automatically brought into relationship.

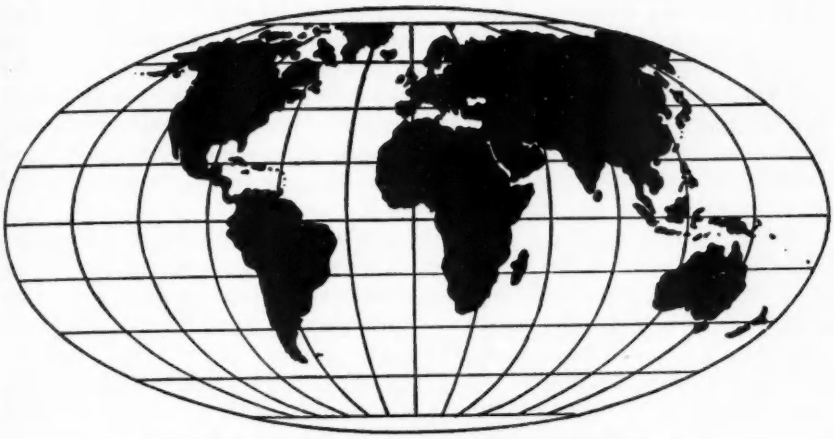
It follows, therefore, that in plotting the distributions of other variables, as, for example, average annual precipitation, or non-agricultural population, the geographer should know what the conceptual relationships are between not only the constants of the projection selected, but also the inherent variables as well.

Geographers are fundamentally concerned with the relative location of things. A moment's reflection shows that the platform for the activities of human life on earth is primarily the land and its adjacent and enclosed waters. Interdependence between the continents and their peoples is today a fact of life. The relative positions as well as the inherent characteristics of the major land areas of the world and their populations have taken on added significance as the complexity and degree of organization of human society has increased. Accordingly, the distribution of many phenomena significant to man and his problems can be better studied in terms of their relative location on the land surface of the earth thought of as a unit. What is the best means of accomplishing this purpose? The answer to this question would seem to be a world map in which the concentration of the major land areas in the so-called land hemisphere would be positioned in such a way as to

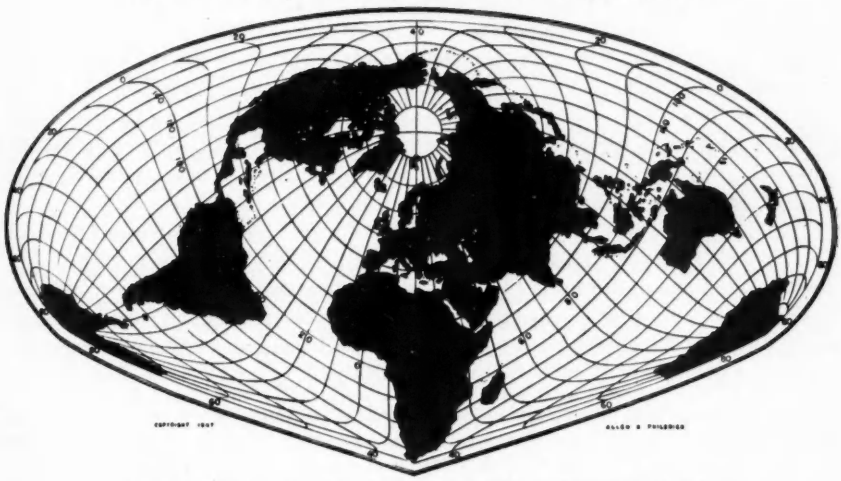
[1] Lucia C. Harrison, *Daylight, Twilight, Darkness, and Time.* (Chicago, 1935). p. 8.

minimize distortion at the same time that the greatest continuity of the land areas with respect to one another is preserved.

Several maps of this type have now been published.[2] They make use of oblique



A. Mollweide Equatorial Equal Area World Map Projection.



B. Sinu-Mollweide Oblique Equal Area World Map Projection.

FIG. 1. Comparison of an equatorial and oblique Mollweide.

[2] Examples of such maps are: 1) John Bartholomew "The Atlantis Projection," *The Regional Atlas of the World.* (Edinburgh, 1948). p. 1; and "The Nordic Projection," *Advanced Atlas of Modern Geography.* (New York, 1950). pp. 22–23; 2) "Oblique Aitoff Projection," *The American Oxford Atlas.* (New York, 1951). p. A1; 3) William Briesemeister, "Elliptical Equal Area Projection." This projection is the base for maps appearing in two articles by

versions of several existing projections. The maps in Figure 1 compare the uninterrupted oblique case of a modified Mollweide[3] with an uninterrupted equatorial aspect of the Mollweide. The oblique presents a very different appearance from its equatorial cousin. Two points of difference are of major importance to the discussion. They are 1) the position of the world's lands, except Antarctica, in the less distorted central portions of the oblique graticule showing the essential polar continuity of the eastern and western hemispheres, and 2) the loss in the oblique case of straight lines for parallels of latitude. This second difference is important because the use of maps with straight or nearly straight-line parallels for world distributions is traditional. Furthermore, the straight equator is a most useful line of departure and orientation.[4]

Straight parallels endow a world map with easy comparability of relative latitudinal position of all points on the earth's surface. Underlying the appreciation of this fact is a basic idea as to why such comparisons are important geographically as well as convenient for reference. Phenomena plotted on such maps are automatically placed in the most effective relationship for study with sun-behaviour. This relationship is fundamental to a concept of geography based upon the observation in the natural science tradition of a chain of relationships in which the sun is the major source of energy affecting a great body of associated phenomena on earth. The resulting concept may be stated in this way. Geographic phenomena developed as the outgrowth of solar energy are associated in area in complex interrelationships. These natural phenomena are not a series of isolated and unconnected items to be studied separately, but in their "togetherness" to be understood as mutually functioning parts of a whole. Such study may be accomplished in part by recording such phenomena on maps which relate them to the force which they have been observed to have in common, i.e. on maps which have, among other characteristics, straight lines for parallels of latitude or equal sun-behaviour lines.

This does not mean, of course, that only data to be compared directly or indirectly with sun behaviour may be appropriately mapped upon grids with straight lines for parallels of latitude.[5] It does mean, however, if relationship to sun behaviour is not a primary objective, that appropriate alternatives with which to express relationships between phenomena and other inherent variables in a projection, in accordance with other concepts of geography, should be considered.

Jacques M. May: "Map of the World Distribution of Helminthiases," *Geographical Review*, XLII (Jan. 1952): 98–101; and "Map of the World Distribution of Dengue and Yellow Fever," *Geographical Review*, XLII (April, 1952): 283–286.

[3] This projection is an uninterrupted version of the Sinu-Mollweide discussed in this paper. It is developed from the equatorial case of a Mollweide with the substitution of a sinusoidal base below 40 degrees south latitude. Hence the name Sinu-Mollweide, from the names Sinusoidal and Mollweide.

[4] Irving Fisher and O. M. Miller, *World Maps and Globes*. (New York, 1944). pp. 89–90.

[5] A conscious purpose of accounting for all phenomena recorded on maps with straight parallels on the basis of deterministic interpretations of the operation of solar energy may not lie behind such procedure; yet the implication is ever present for the unwary.

The lack of straight lines in oblique projections may cost them acceptance by the general public for a time, but certainly should be no insurmountable barrier to the scholar or the geographer providing he understands the conceptual justification for their use. There are a great many phenomena of physical geography which co-vary significantly with land and water contrasts as well as with sun behaviour. There are many additional economic, social, and cultural phenomena of human geography which can be more effectively studied geographically by visualizing their relative location primarily with respect to the world's lands as a unit, than by locating them with primary reference to latitude and sun-behaviour. As a matter of fact, it would be well to examine most phenomena from both standpoints separately, as a means of controlling both variables in the interests of objective areal analysis of spherically-distributed world phenomena on flat maps.

THE SINU-MOLLWEIDE PROJECTION

The interrupted Sinu-Mollweide projection shown in Figure 2 views the earth at an angle of 35 degrees from the plane of the equator. From such an oblique angle the world may be regarded both latitudinally and longitudinally so that both horizontal and vertical axes of the map approximately bisect the land hemisphere. The effect of the positioning of the land areas of the globe as much as possible in the center of the map is a) to minimize distortion since the central portions of projections are in general the most accurate, and b) to maintain the continuity of the land hemisphere. The selection of the angle of 35 degrees from the plane of the equator was made with the latitude of the southern tip of Africa in mind. Africa projects in the southern hemisphere the least of the three southern hemisphere continents, excluding Antarctica. The selection of this angle determines the vertical positioning of the globe surface with respect to the graticule. Positioning Africa on the central axis close to the pointed bottom margin of the map a) removes the great length of the opposite edges of the land hemisphere along the coasts of western North America and eastern Asia as far from the more distorted margins of the world grid as possible, and b) determines the selection of a prime meridian at 20 degrees east of Greenwich. Bringing Africa practically to the margin of the map entails some sacrifice of the shape of South Africa and Madagascar. This is partially overcome by the use of a sinusoidal projection for the bottom portion of the map. The main body of the projection is a Mollweide grid. This grid was selected a) because of its equal area quality, b) because an examination of the angular deformation of ten standard projections demonstrated that it possesses the largest central portion with a minimum acceptable degree of distortion,[6] and c) because

[6] Walter Behrmann, "Auf Kritik der flächentreuen Projecktionen der Ganzen Edre und einer Halbkugel," *Sitzungsberichte der Koniglich Akademie der Wissenschaften Mathematisch-Physikalishche Klasses*, 13 Abhandlung, München, 1909 f.: 48. The ten projections examined were: cylindrical equal area, cylindrical equal area tangent at 30 degrees, Collingnon's trapezoidal, Eckert's trapezoidal, Sanson-Flamsteed or Sinusoidal, Eckert's Sinulinear, Mollweide, Eckert's elliptical, Lambert's equal area azimuthal, and Hammer's or Aitoff's projection.

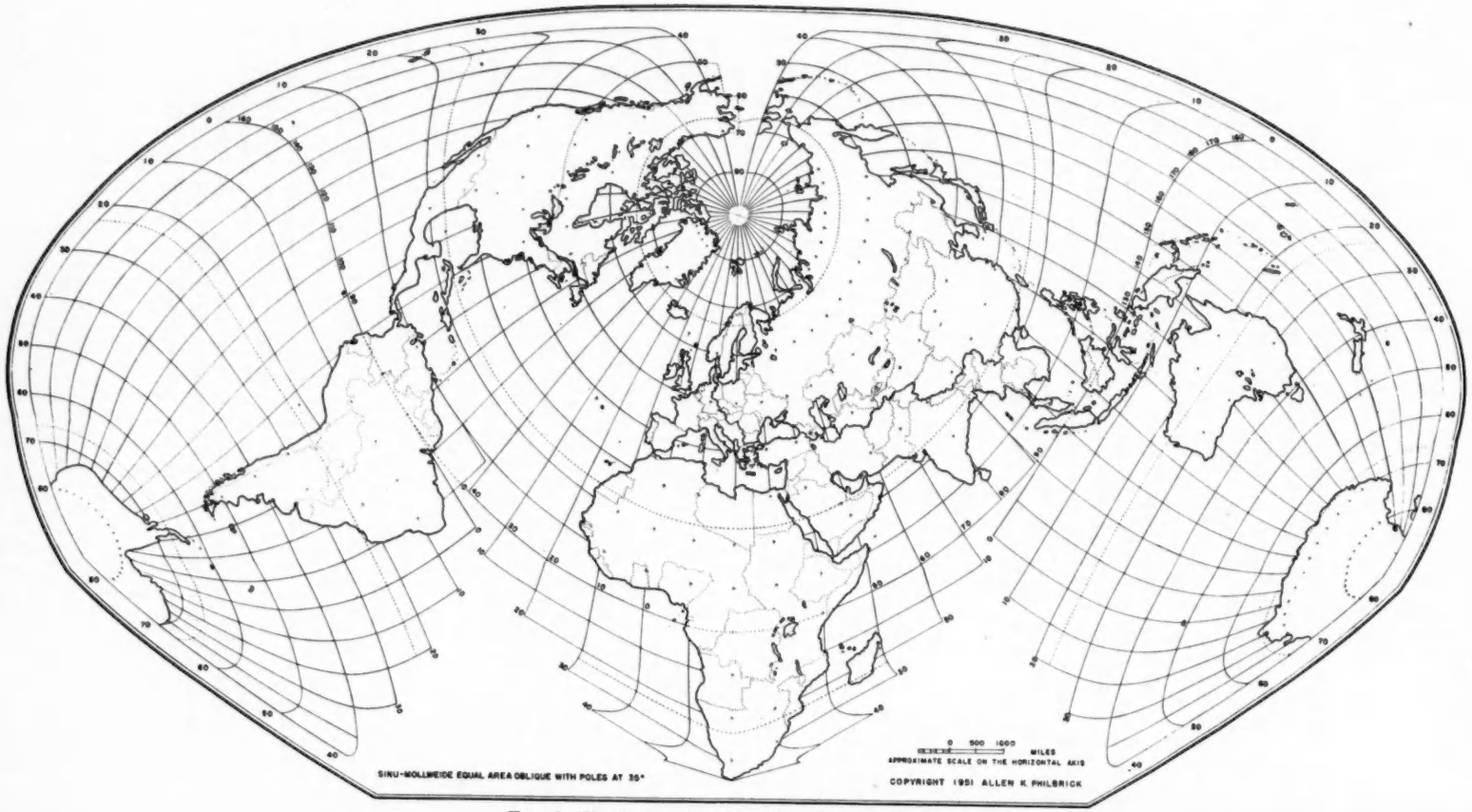

SINU-MOLLWEIDE EQUAL AREA OBLIQUE WITH POLES AT 35°
0 500 1000 MILES
APPROXIMATE SCALE ON THE HORIZONTAL AXIS
COPYRIGHT 1951 ALLEN K. PHILBRICK

FIG. 2. The interrupted Sinu-Mollweide projection.

it readily lends itself to interruption. Three interruptions were made in the combined standard Mollweide grid with its attached sinusoidal portion south of 40 degrees south latitude upon which the oblique graticule appearing in figure 1 was plotted. The purpose of these interruptions is further to minimize distortion of the grid occupied by important segments of the land areas of the world where it could be done without seriously interfering with the essential continuity of the land hemisphere. The two interruptions in the southern hemisphere were contrived to follow different latitude and longitude lines in the oblique case in step-like progression suggestive of the "tearing" of a spherical surface upon its conversion to a plane surface.

The oblique graticule was constructed from points of computed relationship between the standard and the arbitrary grids. The appropriate values, in angular measure from the poles, were plotted accurately on a large scale Mollweide modified and interrupted as described above. The plotted points upon being connected by smooth curves became the oblique graticule upon which the surface of the earth is positioned as shown in Figure 2.

ANGULAR DEFORMATION

A visual comparison by means of Tissot's indicatrix[7] of the angular deformation of the Sinu-Mollweide projection[8] with two equatorial-case projections can be made by comparing Figure 3 with Figures 7 and 8 in Arthur H. Robinson's recent article.[9] The two equatorial-case projections concerned are Goode's homolosine and Finch's interrupted Aitoff. Such comparison reveals major improvement in the oblique case for the bulk of Asia. In the oblique case Asia is entirely within a portion of the grid with less than 20 degrees angular deformation, except for a portion of the Korean peninsula. By contrast in both Goode's and Aitoff's projections, Asia is characterized by angular deformation of more than 20 degrees, deteriorating rapidly over large sections in the northeast to well over 60 degrees angular deformation before the Bering Straits are reached. The same kind of improvement in the Oblique case is true of northern North America.

At the same time comparison shows that the two interrupted equatorial projections postion most of North America, some of South America, Europe, Africa, and all of Oceania only slightly more favorably than is true for the Sinu-Mollweide. The increase in angular deformation in these continental areas is serious only in the cases of southeastern Africa and coastal southwestern North America, where the figures exceed 40 and 30 degrees angular deformation respectively. Comparison of angular deformation alone does not take into account, it must be pointed out,

[7] M. A. Tissot: *Memoire sur la Representation des Surfaces et Les Projections des Cartes Geographiques.* (Paris 1881).

[8] Further mathematical calculations relative to the analysis of the Sinu-Mollweide projections were made by Lucio Chiaraviglio as a student at the University of Chicago.

[9] Arthur H. Robinson: "The Use of Deformational Data in Evaluating World Map Projections," *Annals of the Association of American Geographers,* XLI: 71, 73.

the greater continuity of the land hemisphere in the interrupted oblique case over that which is possible with the interrupted equatorial cases cited. As might be expected, the mean angular deformation of all three projections is approximately the same.[10] In summary it is, therefore, apparent that on the one hand the oblique case achieves a reduction in the range of angular deformation and an overall improvement in the shape and continuity of the world's lands taken as a unit at the expense of a slight increase in angular deformation in most of the continental areas shown with less distortion on the interrupted equatorial cases.

The advantages in reduction of angular deformation to be gained by interruption

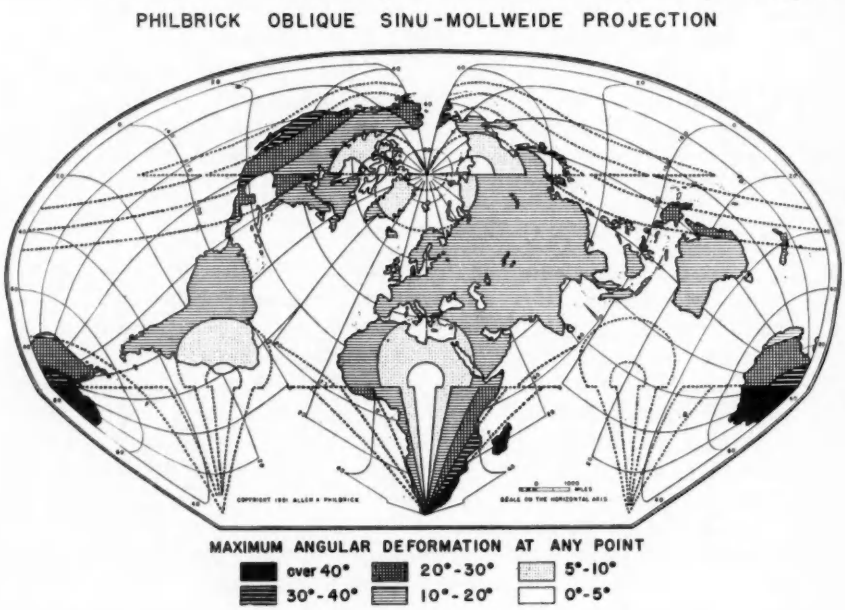


FIG. 3

of an oblique case such as the Sinu-Mollweide shown in Figure 3 may be seen by comparison with the somewhat similar uninterrupted Oxford oblique Aitoff projection[11] shown in Figure 4. In every continental area except Australia angular deformation in the Oxford oblique Aitoff is in some area more than 40 degrees. In the Sinu-Mollweide only Africa and Antarctica have areas with angular deformations

[10] Arthur Robinson, *op. cit.*, p. 72 gives a mean angular deformation for Goode's interrupted homolosine of 15°30′ and for Finch's interrupted Aitoff of 15°15′. The mean angular deformation for the area of the Sinu-Mollweide composed of grid squares containing land area (using a 10° grid) is 15°31′. It would probably be slightly less if computed on the same basis as the deformation values quoted by Robinson.

[11] See the layered relief map of the world in *The American Oxford Atlas.* (New York, 1951). p. A1. Angular deformation data were taken from Behrmann, *op. cit.*, p. 8.

of that degree of magnitude. South America is nowhere deformed more than 18 degrees. Mainland Asia is everywhere characterized by less than 20 degrees angular deformation, except for a small portion of the Korean Peninsula. North America is nowhere more deformed than 35 degrees and mainland Australia, no more than 23 degrees.

ILLUSTRATIONS

The values of oblique projections centering the world's lands are by no means entirely reducible to mathematical measurement. There remains, for example, the visual appearance of the projection. This is related to the question of the continuity

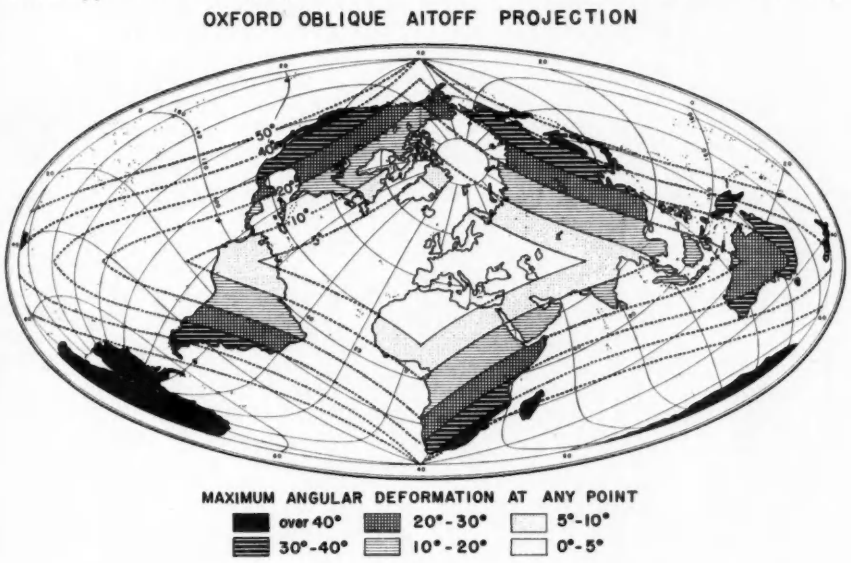


FIG. 4

of continental areas with respect to one another. Can the viewer of the map made upon the projection visualize global relationships readily, or is it difficult to translate the flat map back into its spherical shape in the mind's eye? Such more imponderable characteristics may perhaps best be evaluated by experience. Accordingly, four major patterns of significance are presented, two each from physical and human geography.

The map of average annual precipitation shown in Figure 5[12] shows the arid, humid, and wet areas of the earth in a new way. The major arid region of the world in the northern hemisphere appears on this map in the form of a crescent. This arid crescent nearly encircles the humid lands of the North Atlantic community. Comparison of the shape of the arid crescent with the same area on a

[12] Data from *The Great Soviet World Atlas.* (Moscow, 1937). Plate 34 Vol. I.

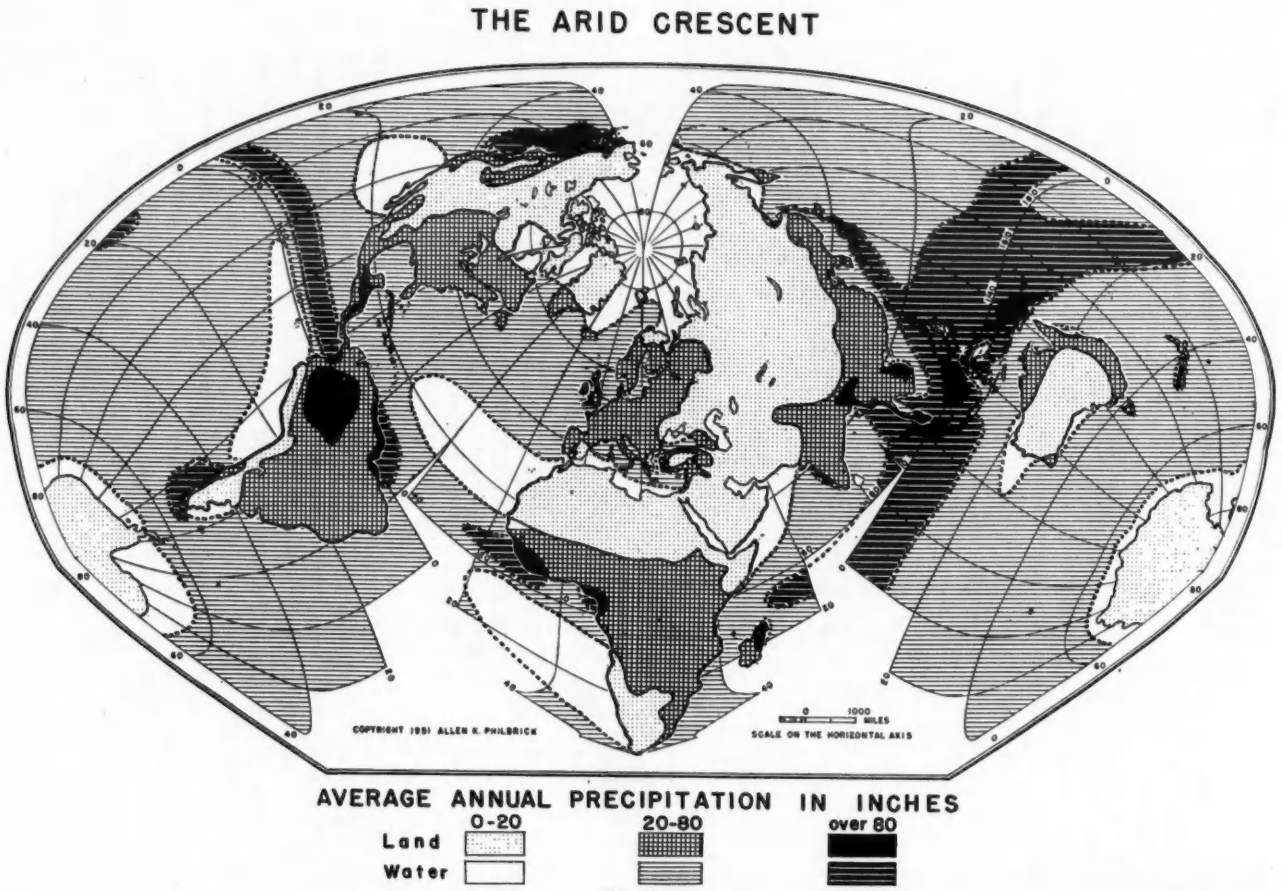

THE ARID CRESCENT
COPYRIGHT 1951 ALLEN K. PHILBRICK
0 1000 MILES
SCALE ON THE HORIZONTAL AXIS
AVERAGE ANNUAL PRECIPITATION IN INCHES
0-20
20-80
over 80
Land
Water

FIG. 5.

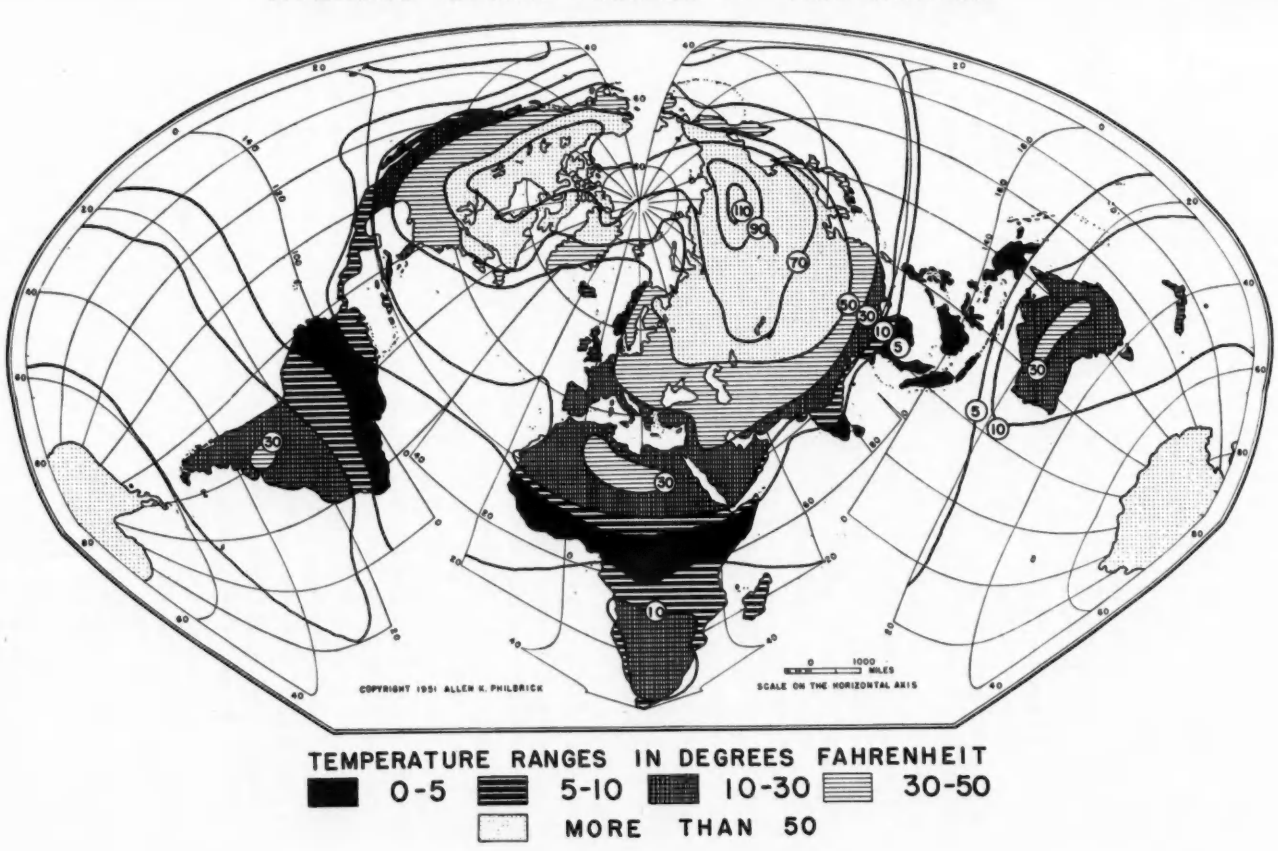

AVERAGE ANNUAL RANGES OF TEMPERATURE
110
90
70
50
30
10
5
30
5
10
30
30
10
COPYRIGHT 1951 ALLEN K. PHILBRICK
0 1000 MILES
SCALE ON THE HORIZONTAL AXIS
TEMPERATURE RANGES IN DEGREES FAHRENHEIT
0-5
5-10
10-30
30-50
MORE THAN 50

FIG. 6.

globe reveals a high degree of faithfulness to reality. Examination of the same phenomenon in any standard Atlas demonstrates the relative difficulty of visualizing this distribution on a map of equatorial aspect. Further examination of the pattern shown in Figure 5 in conjunction with a globe reveals that the arid crescent is itself virtually surrounded by marine west coast, tropical, and monsoon wet lands. These space relations are difficult to visualize from the standard precipitation map. They appear to follow logically from both the globe and the oblique map. Aridity, of course, is a land phenomenon primarily. In the southern hemisphere the map shows four separate smaller arid regions over each of the four continents.

Average annual ranges of temperature as shown in Figure 6[13] further illustrate the way that land and water contrasts are related spatially to the distribution of physical phenomena. In both maps the role of latitude is apparent, but the role of land and water differences is emphasized as it could not be in an equatorial case with straight-line parallels of latitude.

Major world population concentrations, as shown in Figure 7,[14] are closer to one another across the pole than is usually appreciated from their appearance on equatorial-case maps. The spherically triangular relationship between the locations of New York, London, and Shanghai, for example, are more closely approximated on the map in Figure 7 than on any corresponding equatorial case. Great circle routes between such population concentrations cannot be shown by straight lines on either equatorial or oblique cases of projections such as Mollweide, Sinusoidal, and Aitoff. Such routes can, however, be more nearly shown between the continents by straight lines on the oblique than on the equatorial cases. The same is generally true of scale error. The land areas by being concentrated more in the less distorted portions of the grid are shown more truly in direction and distance from one another on the oblique than on the equatorial cases. A comparison of world population as shown in Figure 7 with the map of the arid crescent in Figure 5 reveals strikingly the covariation between population and precipitation.

The map of non-agricultural population and ocean traffic in Figure 8[15] in comparison with world population in Figure 7 shows how the center of gravity of non-agricultural population is in the north Atlantic area in contrast to the preponderance of the world's total population in Asia. The relationship of this concentration of non-agricultural population to the lines of movement of ocean shipping symbolizes the complex division of labor in western industrial societies. The manner in which the lines of ocean traffic surround and tie together the continental pieces of the land hemisphere with a dual focus on London and New York demonstrates the essentially focal character of world organization of commerce between the North Atlantic

[13] After Finch and Trewartha, *Elements of Geography*. (New York, 1949). p. 45.

[14] Data from various sources.

[15] Food and Agricultural Organization of the United Nations, *Yearbook of Food and Agricultural Statistics*. (Washington, 1951). Vol. IV, Part 1, Tables 4a and 4b pp. 15–16 for non-agricultural population; data on ocean traffic after *Goode's School Atlas*. (Chicago, 1949). pp. 44–45.

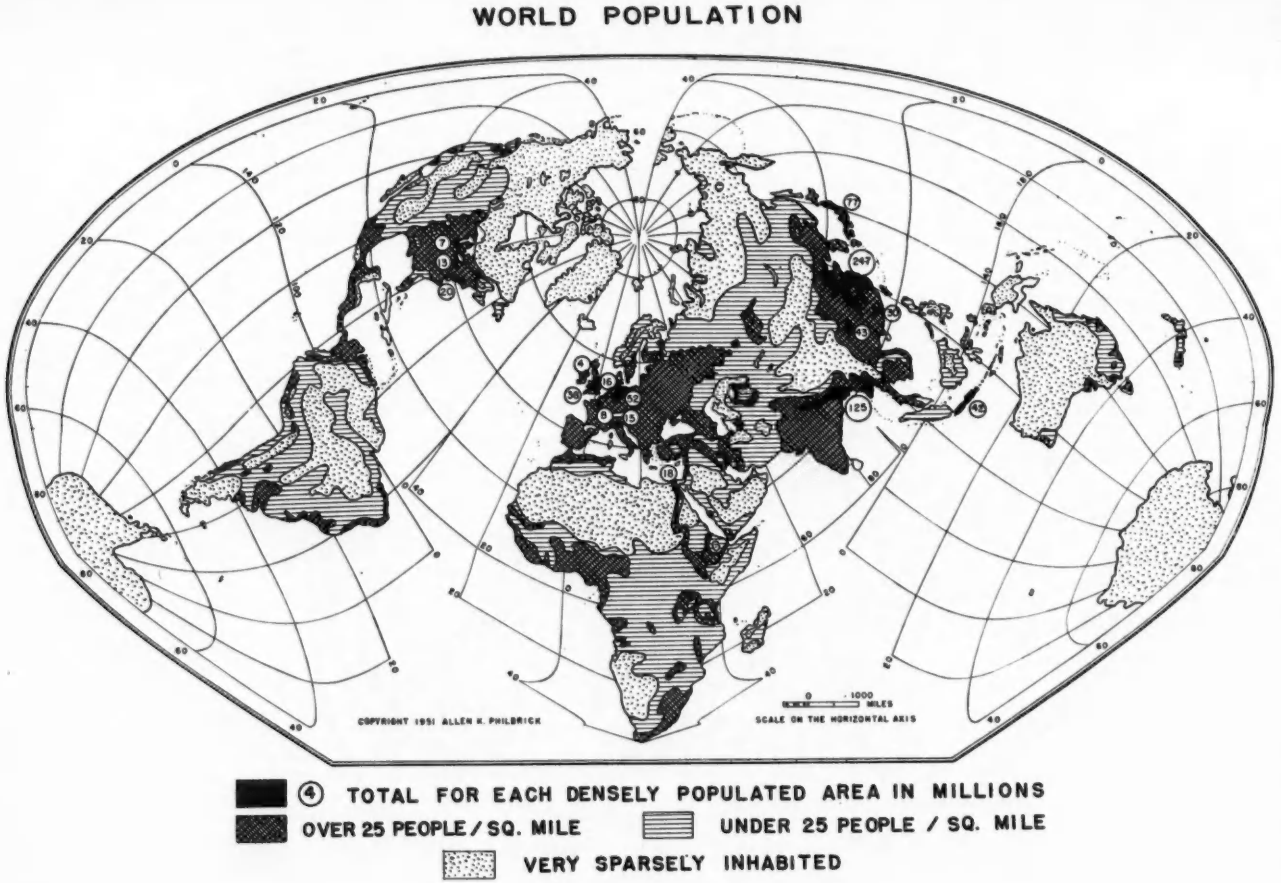

WORLD POPULATION
COPYRIGHT 1951 ALLEN K. PHILBRICK
0 1000 MILES
SCALE ON THE HORIZONTAL AXIS
④ TOTAL FOR EACH DENSELY POPULATED AREA IN MILLIONS
OVER 25 PEOPLE / SQ. MILE
UNDER 25 PEOPLE / SQ. MILE
VERY SPARSELY INHABITED

FIG. 7.

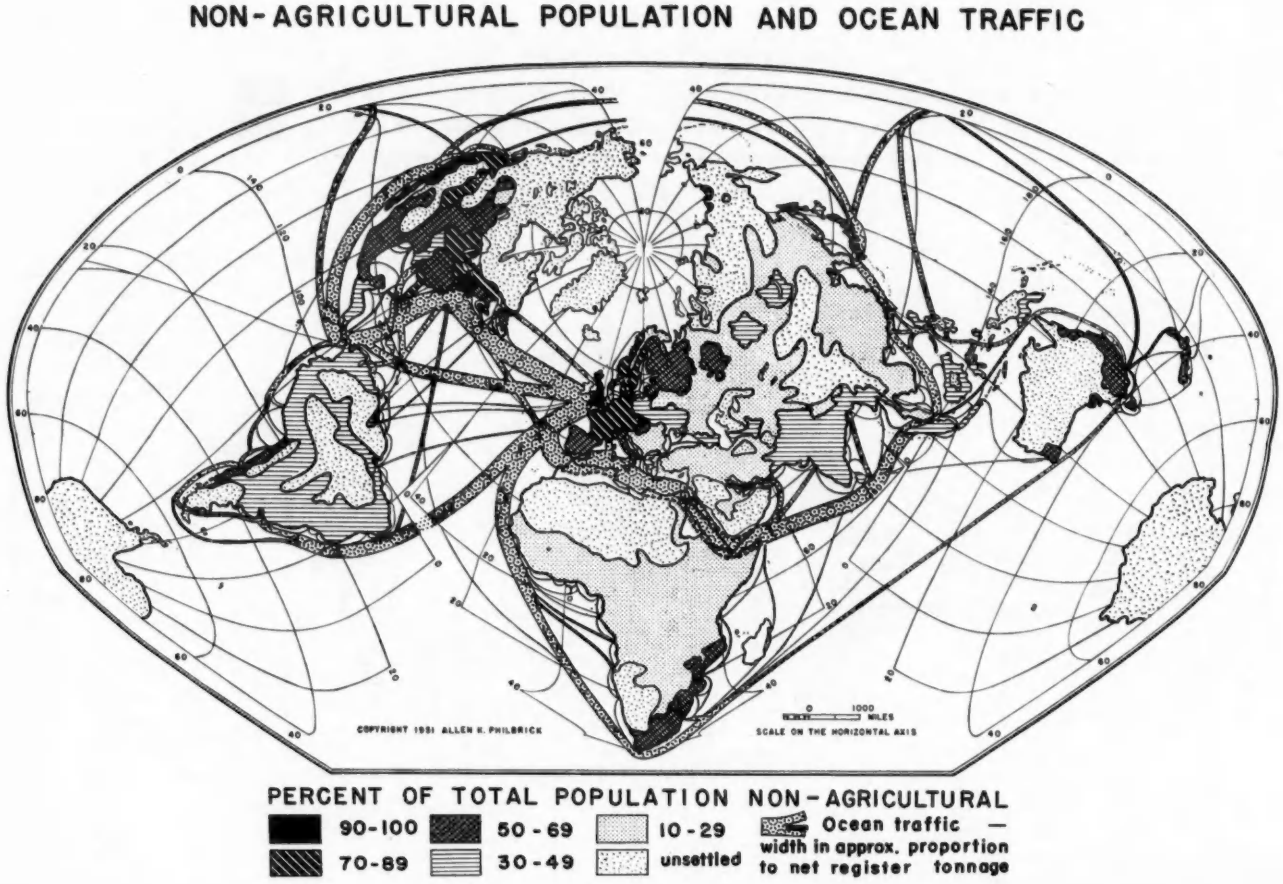

NON-AGRICULTURAL POPULATION AND OCEAN TRAFFIC
COPYRIGHT 1931 ALLEN K. PHILBRICK
0 1000 MILES
SCALE ON THE HORIZONTAL AXIS
PERCENT OF TOTAL POPULATION NON-AGRICULTURAL
90-100
70-89
50-69
30-49
10-29
unsettled
Ocean traffic — width in approx. proportion to net register tonnage

FIG. 8.

nations and the rest of the world's lands. The enclosed nature of the North Atlantic-Arctic oceans between eastern and western hemisphere land masses is accurately portrayed. The alignment of the Panama and Suez canals on the North Atlantic-Mediterranean-North Indian Ocean main axis of ocean shipping is shown effectively. This line roughly divides the land hemisphere into northern and southern halves. The compact nature of the pattern of ocean traffic in its association with the land hemisphere is shown to advantage with a minimum of breaking of important routes. The only lines of shipping that leave and re-enter the map at its edges are those of the Pacific Ocean and the south Indian Ocean. These involve only a small proportion of the world total register tonnage.

CONCLUSION

An examination of the Sinu-Mollweide oblique projection leads to the following conclusions. The idea behind such maps is that in a world which is increasingly "one world" the significance of many phenomena is more readily appreciated on maps maintaining the continuity of intercontinental locational relationships. The mean angular deformation for the land is approximately the same for the Sinu-Mollweide as that for Goode's Homolosine or the interrupted version of Aitoff, but with a marked reduction in the range of deformation. At the same time the continuity of the world's lands is essentially maintained despite grid interruptions in a way not possible in equatorial cases. Similarly, comparison with the Oxford Oblique Aitoff reveals that the interruption of an oblique can at a minimum reduce by approximately 10 degrees the maximum angular deformation for every continent.

Finally, the illustrations of the projection's uses by four patterns of geographic significance demonstrate the clarity with which, on a flat map, phenomena may be visualized globally with reference to the world's lands as a whole.

INTERRUPTING A MAP PROJECTION: A PARTIAL ANALYSIS OF ITS VALUE*

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THE interruption of map projections is one of the contributions of America to cartography, but, like so many projectional ideas, it was presented without prior testing of its qualities. Nevertheless it has become relatively popular, and for the past several decades interrupted or recentered projections have been liberally used in our text books and atlases. Occasionally one may see a polar interruption or a so-called "star" projection, but the most common are those having a continuous equator with lobate extensions on either side. Rather extensive claims have been made as to the merits of these modifications such as "The recentered sinusoidal gives the continents the best possible shape," or the assertion that in the Homolosine "the continents are given better form than in any other world map projection." Such statements imply that the value of interrupting a projection had been measured; but they were not, to my knowledge, based upon any commensurable data.

The complete analysis of the worth of a projection for a particular purpose involves many factors. Some of these are not capable of evaluation except through extensive testing techniques. For example, one can make no well-founded assertions regarding the effect on the map reader, especially the young one, of the lack of the impression of sphericity caused by repeating the position of the poles. Other such qualitative kinds of factors which do not lend themselves to rigorous testing, but which must enter into a complete evaluation are too numerous to mention. On the other hand, at least one kind of quantitative evaluation is possible, viz., the comparison of the mean angular deformation on the interrupted phase of the projection with that of the uninterrupted. This paper will attempt to compare several world projections on this basis.

THE METHOD OF INTERRUPTION AND EVALUATION

All that is necessary to interrupt and recenter a projection in the usual manner is to make sure that the parallels are uniformly subdivided by the meridians, or, to put it another way, to make sure that the linear scale along each parallel is uniform. Any number of central meridians may be chosen and the grid constructed around each; no central meridian need extend any particular latitudinal distance; the central meridians in opposite hemispheres need not match; and, as a matter of fact, a central meridian may even be displaced from latitude to latitude. In spite of these almost unlimited possibilities, cartographers have been relatively conservative in presenting

* This study was supported in part by research grants from the Graduate School of the University of Wisconsin. Graduate research assistants were Robert Will, James J. Flannery and Jerry B. Culver.

interrupted projections. Many projections that lend themselves to interruption have not been so treated.

The majority of the projections that have been interrupted have been equivalent projections. Without interruption the property of uniform *area* scale, so useful to the geographer, puts such a strain on the *linear* scale relationships that these projections have a relatively high degree of angular deformation. The angular alteration is, of course, least along the lines of minimum linear scale discrepancy or, in such cases as the Mollweide and Eckert IV, for example, around the points of minimum linear scale discrepancy. When, through interruption and recentering, these lines or points are duplicated on the presentation, then no land area need be far removed from the area of least angular alteration. Thus, the deformation of the significant parts of the map, the land, may be considerably reduced. This is evident from even a cursory consideration, and it is rather surprising, to say the least, that so simple a method for reducing angular alteration was not thought of earlier.

This method of interruption and recentering is best known from the accomplishments of the late Professor J. Paul Goode. He began with the sinusoidal, but its pointed features distressed him, and he next modified the Mollweide.[1] The considerable linear scale inequalities in the equatorial section of the Mollweide, which results in north-south "stretching" or east-west "squeezing," also disturbed him. So he joined the two projections to make the Homolosine with its characteristic irregular meridians.[2]

The results of Professor Goode's manipulations provide an interesting and convenient example of the method employed to evaluate this one aspect of the worth of interruption. The procedure and its development from the works of Tissot and Behrmann was the subject of an earlier article in the *Annals*.[3] It consists essentially of four steps:

1. Outlining the land areas of major interest (Antarctica is excluded).
2. Plotting the values and drawing the lines of equal maximum angular deformation (2ω).[4]
3. Measuring with a planimeter the land area enclosed by succeeding isolines.
4. Deriving the mean of the angular deformation for the land from a graph of deformation plotted against area in the manner one can derive mean elevation from a hypsographic curve.

Any method of evaluation cannot be completely satisfactory when applied to

[1] J. Paul Goode, "Studies in Projection: Adapting the Homalographic Projection to the Portrayal of the Earth's Surface Entire," *Bulletin of the Geographical Society of Philadelphia*, XVII (1919): 103–13.

[2] J. Paul Goode, "The Homolosine Projection: A New Device for Portraying the Earth's Surface Entire," *Annals of the Association of American Geographers*, XIV (1925): 119–125.

[3] Arthur H. Robinson, "The Use of Deformational Data in Evaluating Map Projections," *Annals of the Association of American Geographers*, XLI (1951): 58–74.

[4] *Ibid.* p. 60, for definition of terms.

phenomena capable of infinite variation. This is certainly true with respect to the interruption of projections, since any meridian may be chosen as central. Consequently, to arrive at a final answer would theoretically require the analysis of an infinite number of possibilities. The only reasonable alternative is to determine the change in mean angular deformation that occurs when the projection is interrupted along "conventional" lines. The selection of suitable central meridians for North America, South America, South Africa, and Australia is not difficult. The "perfect" choice, if such be possible, would create mechanical difficulties in construction in that it would require some odd-numbered meridians to be chosen. These could not be shown on the final representation if the grid were conventionally indicated, e.g. a ten-degree grid. It is probably correct, moreover, that a shift of the central meridian 10° to the west or east would have little effect on mean values for the entire land area.

The east-west extent of Eurasia is, however, a real problem to the interrupter of a projection. If he puts the central meridian near the center of the land mass both Europe and the Far East appear with considerable angular distortion. Whichever part of Eurasia is favored by moving the central meridian toward it is bettered only at the expense of the other.

Professor Goode did his first interrupting with the sinusoidal projection. The angular deformation for the central portion of this projection was first calculated by Tissot.[5] Later Behrmann extended the calculation to the entire projection.[6] The angular deformations on the familiar sinusoidal (Fig. 1) range from 0° along the equator and the central meridian to a maximum of over a 100°. If the land be plotted on the projection in the conventional manner so that the Prime Meridian is the central meridian, the mean deformation of the land area (excluding Antarctica) is approximately 35°. The first interrupted map projection apparently was the sinusoidal with Europe "cleft from her sister Asia" by the use of both 20° E and 120° E as central meridians for Eurasia (Fig. 2). Calculation of the mean deformation for this example of interruption reveals that, if Professor Goode had been aiming only at reducing the angular deformation, his first attempt was his best.[7] Determination of the mean deformation of the land area for this interruption gives a value of just over 12°. Such a low mean value is due, of course, to the separation of Asia into two parts, a cleavage that may be considered cartographically inappropriate for a world map showing land areas.

No further interruption of the sinusoidal was made by Professor Goode who then turned to the Mollweide and finally developed the Homolosine from the union

[5] M. A. Tissot, *Mémoire sur la Représentation des Surfaces et les Projections des Cartes Géographiques.* Paris, 1881. Table XIV.

[6] Walther Behrmann, "Zur Kritik der flächentreuen Projektionen der ganzen Erde und einer Halbkugel," *Sitzungsberichte der Königlich Bayerische Akadamie der Wissenschaften, Mathematisch-Physikalische Klasse* (Munich, 1909) 13. Abhandlung: 46.

[7] The analysis of this interruption of the sinusoidal and of one more conventionally interrupted was made by Edwin E. Boughton as part of an independent graduate research project.

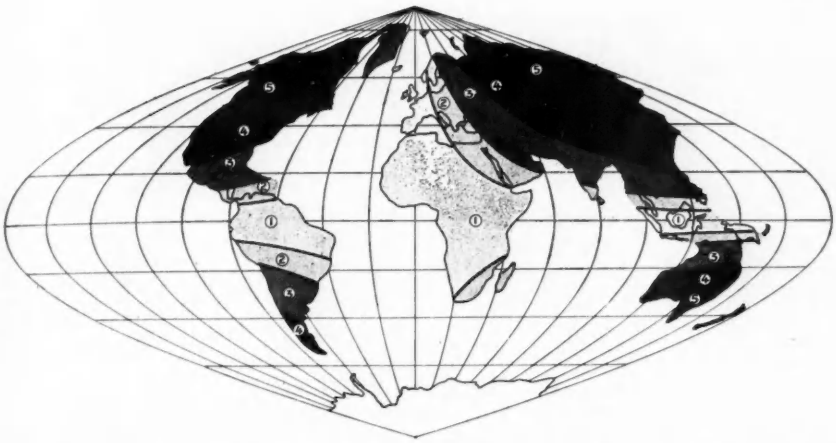

FIG. 1. The sinusoidal projection showing isolines of angular deformation. The values of 2ω are: zone 1, 0°–10°; zone 2, 10°–20°; zone 3, 20°–40°; zone 4, 40°–60°; zone 5, over 60°. The mean deformation for land areas is 35°36′.

of the sinusoidal and the Mollweide. In order to be able to draw some conclusions regarding this aspect of the worth of interruption the sinusoidal was interrupted along more conventional lines (Fig. 3).[8] This interruption has a mean angular deformation of over 19°.

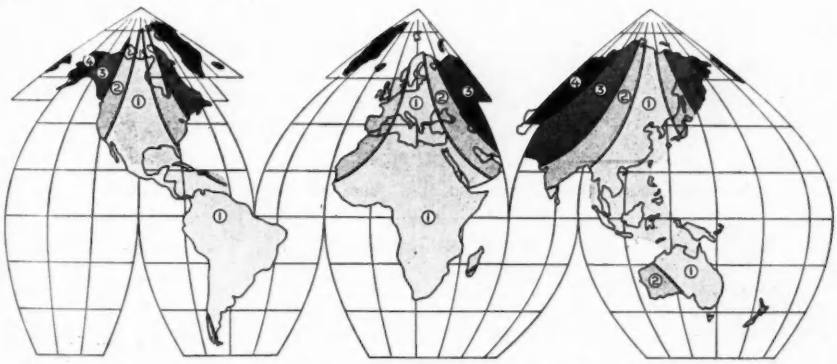

FIG. 2. The sinusoidal projection interrupted by Goode. The values of 2ω are: zone 1, 0°–10°; zone 2, 10°–20°; zone 3, 20°–40°; zone 4, 40°–60°; zone 5, over 60°. The mean deformation for land areas is 12°8′. (Drawn by Edwin E. Boughton)

[8] The selection of central meridans in this and some of the other interruptions illustrated can be questioned. Their placing on the continental masses was dictated by expediency in the mechanics of the interruption and analytical processes. More precise position was considered unnecessary since the end results for the purposes of this study could hardly have been affected.

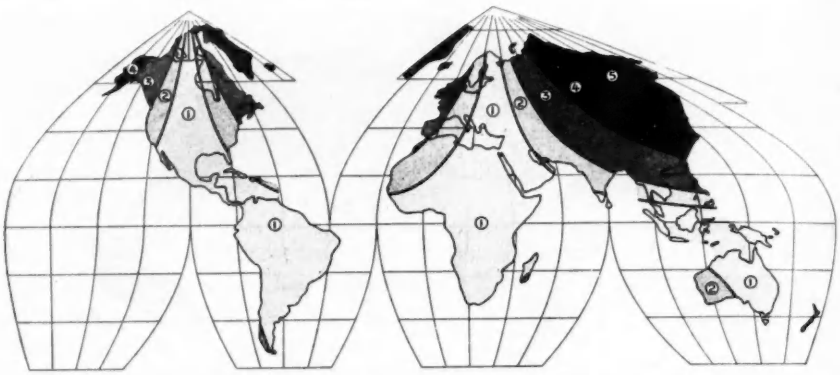

FIG. 3. The sinusoidal projection interrupted along conventional lines. The values of 2ω are: zone 1, 0°–10°; zone 2, 10°–20°; zone 3, 20°–40°; zone 4, 40°–60°; zone 5, over 60°. The mean deformation for the land areas is 19°20′.

If the interruption of the sinusoidal which splits Eurasia be disregarded, it is apparent that by providing each continent with its own central meridian, or "line of strength," the mean angular deformation is reduced by almost half, i.e., from more than 35° to just over 19°. Such a reduction seemed rather large and certainly one should make no generalization regarding the effect of interruption on mean angular deformation from one sample, beyond the obvious fact that there has been reduction. Accordingly a number of other projections which lend themselves to interruption were analyzed.

FLAT POLAR QUARTIC AUTHALIC

In an attempt to distribute to better advantage the inherent angular deformation on an equal area world projection, McBryde and Thomas proposed a series of

TABLE I*

Angular Deformation (ω) on the Flat Polar Quartic Authalic Projection

	0°	20°	40°	60°	80°	100°	120°	140°	160°	180°
5°	3° 43′	4° 51′	5° 43′	6° 29′	7° 14′	8° 04′	8° 44′	9° 25′	9° 59′	10° 36′
15°	3 03	4 05	5 31	6 54	8 23	9 49	11 23	13 06	14 58	17 00
25°	1 44	6 16	7 11	9 10	11 26	14 19	17 20	19 58	22 22	24 37
35°	0 00	5 00	9 43	12 13	15 49	19 00	22 30	25 53	29 10	32 04
45°	3 16	7 07	11 01	15 33	19 43	24 04	28 05	31 49	35 07	38 04
55°	7 34	10 19	14 26	19 20	23 50	28 23	32 48	36 51	40 40	44 16
65°	14 19	15 59	19 17	23 50	28 46	33 50	37 55	41 46	45 10	51 32
75°	27 12	27 48	29 14	31 44	34 35	38 04	41 10	44 05	46 46	49 16
85°	60 12	60 15	60 16	60 20	60 25	60 32	60 41	60 50	61 00	61 13

* The values in Table I were derived in part by graphic procedures, hence they are subject to some minor errors.

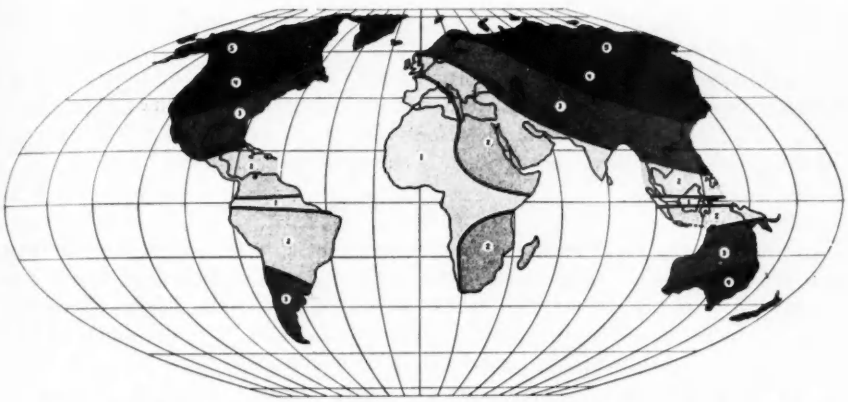

FIG. 4. The flat polar quartic authalic projection. The values of 2ω are: zone 1, 0°–10°; zone 2, 10°–20°; zone 3, 20°–40°; zone 4, 40°–60°; zone 5, over 60°. The mean deformation for the land areas is 31°.

projections based on the Eckert principle.[9] These projections shortened the lines representing the poles to one quarter and one third the length of the equator. One of the latter, a modification of the Adams authalic projection and named the flat polar quartic authalic, was selected as the base for plotting hemisphere census maps and full tables for its construction were presented. Since the projection seemed to have obvious merit the deformation pattern was determined. The pattern is shown in Figure 4 plotted on the land area when the central meridian is 0°. The pattern

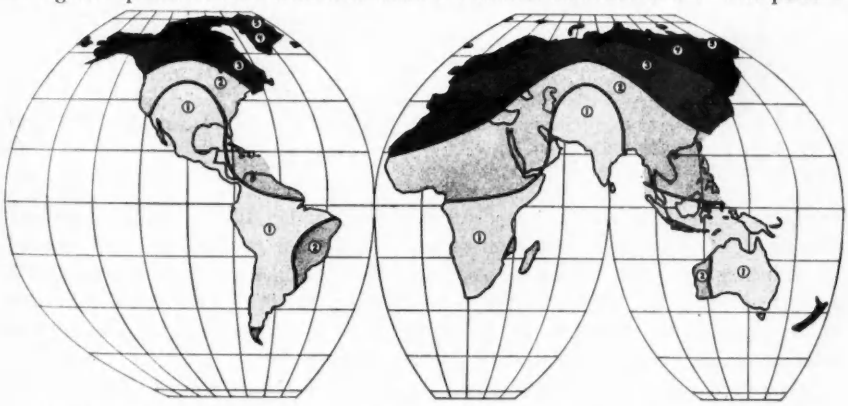

FIG. 5. An interrupted flat polar quartic authalic projection. The values of the categories of angular deformation are the same as those shown in Figure 4. The mean deformation for the land areas is 18°19′.

[9] F. W. McBryde and Paul D. Thomas: *Equal-Area Projections for World Statistical Maps*, Sp. Publ. No. 245, Coast and Geodetic Survey, Washington, 1949.

is similar to other projections of this type, and the mean angular deformation is 31°, a figure well under that for the sinusoidal.

Figure 5 shows the flat polar quartic authalic interrupted. The mean deformation for the land area when the projection is interrupted in this fashion is just over 18°. Although the reduction of the deformation is not so great as it is in the case of the sinusoidal the mean deformation of the interruption is less.

OTHER INTERRUPTED OVAL PROJECTIONS

Since the only requirements for the interruption of oval equal-area projections are straight parallels, and consequently uniformly spaced meridians, there is a large number of projections from which one may choose. The Eckert IV projection has been frequently employed in Europe, but not in America; and since the interruption of projections has not been common in Europe, it is not surprising that,

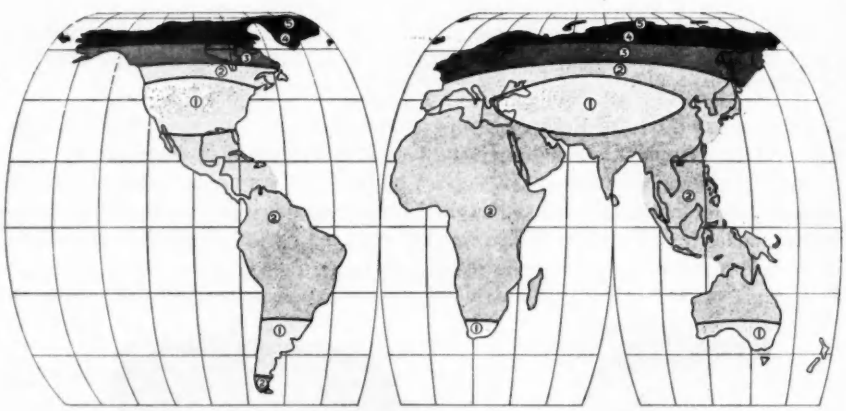

FIG. 6. An Eckert IV projection interrupted. The values of 2ω are: zone 1, 0°–10°; zone 2, 10°–20°; zone 3, 20°–40°; zone 4, 40°–60°; zone 5, over 60°. The mean deformation for land area is 17°54′.

so far as the author knows, this projection has not heretofore been so modified. The maximum angular deformation values (2ω) for the projection were presented by Behrmann.[10] The values are shown in their basic pattern on Figure 6, the projection being interrupted in the conventional manner. The mean deformation on the uninterrupted Eckert IV (land area) is 24°45′; when the projection is interrupted the mean deformation drops to just under 18°.

One of the projections interrupted by Professor Goode was the Mollweide.[11] The analysis of the angular deformation in the Mollweide system of projection was first accomplished by Tissot and extended by Behrmann.[12] When the projection is constructed with the prime meridian as the central meridian the mean deforma-

[10] Behrmann, *op. cit.*, p. 47 and map 8.

[11] Goode: "Studies in Projection . . . ," *loc. cit.*

[12] Behrmann: *op. cit.*, p. 47 and map 7.

TABLE II

Projection	Mean Deformation Entire Projection	Mean Deformation Land Area
Eckert IV	27°34′	24°45′
Truncated sinusoidal	32°30′	29°12′ (approx.)
Truncated elliptical	31°06′	27°57′ (approx.)
Truncated parabolic	30°50′	26°59′ (approx.)

tion for the land area is 29°. When interrupted in the conventional manner the mean deformation drops to 17°.[13]

Three new equivalent projections which lend themselves to interruption have been presented by Werenskiold.[14] These projections, called the truncated sinusoidal, parabolic, and elliptical each represent the pole, like the Eckert IV, with a line half the length of the equator. Tables of deformation values were presented by Werenskiold as well as the isolines of deformation on the projection themselves, an excellent practice, which should be standard procedure when proposing new projections. The mean maximum angular deformation values of the three projections (entire projection rather than the land area) were computed by Werenskiold and are shown in Table II. It may be reasonably assumed that the deformation for the land area alone, excluding Antarctica, will be reduced by approximately the same proportion as obtains on the Eckert projection since the patterns of deformation are similar. These assumed values, derived from the Eckert proportion, are shown in Table II.

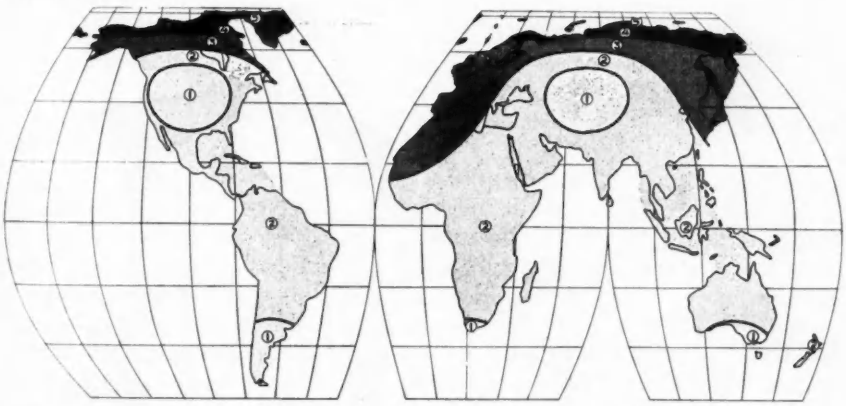

FIG. 7. A truncated sinusoidal projection interrupted. The values of 2ω are: zone 1, 0°–10°; zone 2, 10°–20°; zone 3, 20°–40°; zone 4, 40°–60°; zone 5, over 60°.

[13] Computed by Edwin E. Boughton.

[14] W. Werenskiold, "A Class of Equal Area Projections," *Det Norske Videnskaps-Akadami i Oslo, Matematisk-naturvidenskapelig Klasse,* No. 11, 1944 (in English).

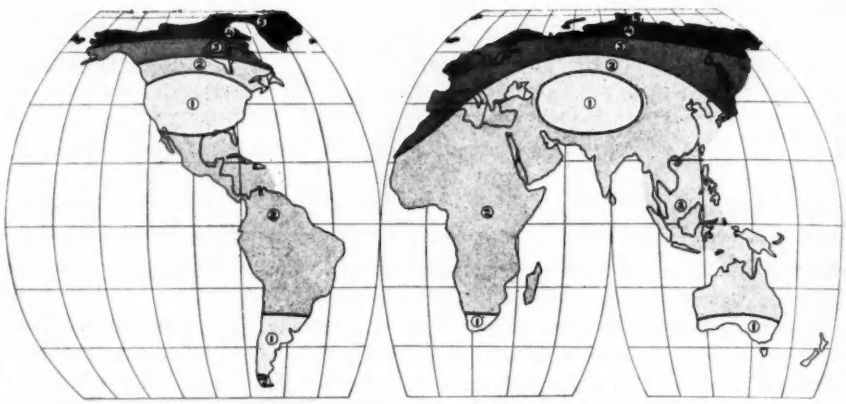

FIG. 8. A truncated elliptical projection interrupted. The values of 2ω shown are the same as in Figure 7.

When Werenskiold's projections are interrupted in the conventional manner, shown in Figures 7, 8, and 9, the deformation of the land area is reduced to 18°30′ on the truncated sinusoidal, and to 18° on the truncated elliptical and parabolic.

CONCLUSIONS

The mean deformation values of the land areas on the uninterrupted and interrupted projections are arranged in Table III together with the percentage reduction that has occurred. Several conclusions are evident from an examination of Table III:

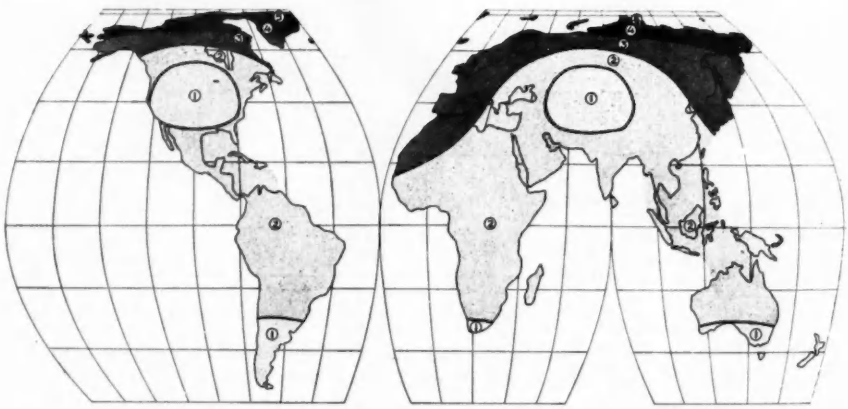

FIG. 9. A truncated parabolic projection interrupted. The values of 2ω shown are the same as in Figure 7.

TABLE III

Projection	Mean Deformation of Land Area		Approximate Percentage Decrease
	Uninterrupted	Interrupted	
Sinusoidal	35°36′	19°20′	46%
F.p. quartic authalic	31°00′	18°19′	41%
Trun. sinusoidal	29°12′	18°30′	37%
Mollweide	29°00′	17°00′	41%
Trun. elliptical	27°57′	18°00′	36%
Trun. parabolic	26°59′	18°00′	38%
Eckert IV	24°45′	17°54′	28%

1. Mean deformation of the land is a significant element of choice between these projections in their *uninterrupted* form as is evident from the wide range of values.
2. It may be seen that in each case there has been a significant decrease in deformation due to interruption.
3. More significant, however, than the above fact, which hardly needs proof, is the fact that, no matter what the mean deformation of the land may be on the projection before interruption, the values after interruption fall within a range of only about 2°.
4. Insofar as the mean deformation on interrupted projections is concerned, there seems to be little to choose between them. This is quite the opposite of the situation that obtains with respect to their uninerrupted forms.
5. The generalization can probably be made that interruption cannot reduce the mean deformation much below 18° unless a land mass be split or appropriate portions of different projections be joined. Even the interrupted Homolosine has a mean value of only 1°30′ less than the interrupted Mollweide.[15]

To generalize further from the above results, it may be concluded that, if an interrupted equivalent world projection seems to be desirable for a particular map, the basis of choice should be the pattern of the deformation on the individual projections. The fact of interruption is not in itself a valid justification.

Whether the obviously significant decrease in mean angular deformation because of interruption, together with a fortuitous distribution of the deformation pattern, can compensate for the unrealistic separation of land masses is a problem peculiar to the subject matter of each proposed map, and no generalizations are possible.

[15] Robinson: *op. cit.*, p. 71.

EXCEPTIONALISM IN GEOGRAPHY: A METHODOLOGICAL EXAMINATION*

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THE methodology of a field is not a grab bag of special techniques. In geography such techniques as map making, "methods" of teaching, or historical accounts of the development of the field are still often mistaken for methodology. It is one of the purposes of the present paper to help dispel this confusion. Methodology proper deals with the position and scope of the field within the total system of the sciences and with the character and nature of its concepts.

Methodology thrives on change and evolution. In an active field concepts are continuously either refined or entirely discarded; laws and hypotheses are, as the case may be, confirmed or disconfirmed or, perhaps, reduced to the status of no longer satisfactory approximations. Methodology is the logic of this process. That is why, particularly in young disciplines, methodological debate is a sign of health. Seen in this light, the methodology of geography is too complacent. Some fundamental ideas have remained unchallenged for decades though there is ample reason to doubt their power. Some others, half forgotten, lie scattered around, exposed to slow erosion like the tells in the plain of Iraq. Spethmann[1] made this point when he complained in 1928 that the methodology Hettner[2] had just published was in the main a collection of articles twenty or thirty years old, at a time when virtually all the other sciences experienced almost hectic change and progress. Turning to America, one may add that Hartshorne[3] in 1939 restated many of Hettner's views with little change or criticism. Worse than that, Hartshorne's own work, undoubtedly an important milestone in the history of American geographical thought, went itself unchallenged through the thirteen years that have passed since its publication.

The methodological literature is small. Alexander von Humboldt, rightly called the father of scientific geography, was also the first relatively modern author to pay attention to the logic of its concepts. Two generations passed before the next major contribution was made by Hettner. But only two years after Hettner's book

* I am much indebted to Professor Gustav Bergmann of the Philosophy Department of The State University of Iowa who has kindly read the manuscript and made many valuable suggestions.

** Editor's Note. Professor Fred K. Schaefer died on June 6, 1953. Galley for this article was read by Professor Gustav Bergmann.

[1] Hans Spethmann, *Dynamische Länderkunde*. Breslau, 1928. p. 119.

[2] Alfred Hettner, *Die Geographie, ihre Geschichte, ihr Wesen und ihre Methoden*. Breslau, 1927.

[3] Richard Hartshorne, "The Nature of Geography," *Annals of the Association of American Geographers*, XXIX (1939): 171–658. Reprinted in book form. Page references cited below are to the 4th edition (1951).

had appeared an Austrian philosopher of science, Viktor Kraft,[4] published an essay in the field which is as yet unexcelled in clarity and succinctness. Hartshorne's work in this country was the only other, and is so far the last major attempt. It will appear from the following discussion that while Hartshorne follows Hettner rather closely in some respects, Kraft may be said to continue more nearly the tradition of Humboldt.

I

Geographers writing on the scope and nature of geography often begin quite apologetically as if they had to justify its very existence. And strangely, or perhaps, psychologically speaking, not so strangely, they go on claiming too much. In such writings geography, together with history, emerges as *the* "integrating science," completely different from other disciplines, whose unique importance finds its expression in the special methods which it must use to reach its profound results. Unhappily, the actual results of geographical research, while not to be minimized, are somewhat lacking in those startling new and deeper insights which one is led to expect from such exuberant characterizations of the field. In fact, the progress of geography was slower than that of some other social sciences such as, for instance, economics. Some of this lag is perhaps due to the unrealistic ambitions fostered by the unclear idea of a unique integrating science with a unique methodology all its own. On the other hand, there is no need for the apologies which so often precede the exaggerated claims. The existence of a field is after all mainly the product of the division of labor; it needs no "methodological" justification. In this obvious sense geography is no doubt an important field.

With the development of the natural sciences in the eighteenth and nineteenth centuries it became apparent that mere description would not do. Description, even if followed by classification, does not explain the manner in which phenomena are distributed over the world. To explain the phenomena one has described means always to recognize them as instances of laws. Another way of saying the same thing is to insist that science is not so much interested in individual facts as in the patterns they exhibit. In geography the major pattern-producing variables are, of course, spatial. Humboldt, who had come from the natural sciences, and also Ritter, accepted the proposition that all natural relations and, therefore, all spatial relations, were governed by laws. For this new type of work tools had to be provided in the form of concepts and laws. Hence geography had to be conceived as the science concerned with the formulation of the laws governing the spatial distribution of certain features on the surface of the earth. The latter limitation is essential. For, with the successful rise of geophysics, astronomy, and geology, geography can no longer deal with the whole earth, but only the earth's surface and "with the earthly (irdischen) things that fill its spaces."[5]

[4] Viktor Kraft, "Die Geographie als Wissenschaft," in *Enzyklopädie der Erdkunde,* ed. Oskar Kende. Leipzig, Wien, 1929.

[5] Carl Ritter, *Über die historischen Elemente in der geographischen Wissenschaft.* Berlin, 1833. p. 45.

Humboldt and Ritter thus recognized as the major concern of geography the manner in which the natural phenomena, including man, were distributed in space. This implies that geographers must describe and explain the manner in which things combine "to fill an area." These combinations change, of course, from area to area. Different areas contain different factors or the same factors in different combinations. These differences either in the combination of factors or in their arrangement from place to place underlie the common sense notion that areas differ. Following the Greek geographers, this viewpoint is called the chorographic or chorological one, depending on the level of abstraction. Geography, thus, must pay attention to the spatial arrangement of the phenomena in an area and not so much to the phenomena themselves. Spatial relations are the ones that matter in geography, and no others. Nonspatial relations found among the phenomena in an area are the subject matter of other specialists such as the geologist, anthropologist, or economist. Of all the limitations on geography this one seems to be the most difficult for geographers to observe. To judge even from recent research they do not always clearly distinguish between, say, social relations on the one hand and spatial relations among social factors on the other. Actually, one may safely say that most of what we find in any given area is of primary interest to the other social scientists. For instance, the connections between ideology and political behavior, or the lawful connections between the psychological traits of a population and its economic institutions do not concern the geographer. If he attempts to explain such matters the geographer turns into a jack of all trades. Like all others the geographer had better cultivate his speciality, the laws concerning spatial arrangements. But to say this is not to say that some of these "geographical" laws are not of interest to other disciplines.

Kraft, in discussing Humboldt and Ritter, agrees with them that geography is, at least potentially, a science trying to discover laws; that it is limited to the earth's surface; and that it is essentially chorological. Incidentally, he also feels that this suffices to set geography logically apart as a disciplne of its own.

The chorological viewpoint presented geography with a problem that has caused more methodological controversy and misunderstanding than any other. The geographer's investigations, be he a physical, economic, or political geographer, are of two different types: either *systematic* or *regional*. A region contains, to be sure, a special, unique, yet in some ways uniform combination of kinds or categories of phenomena. The detail with which the regional geographer describes, lists, or catalogues these features at the outset of his investigation depends, of course, on the size of the region considered. Next he will want to gather information as to the spatial distribution of the individuals in each class. But this information, too, belongs to his data rather than his results. For it does not go beyond mere description. His proper task as a social scientist begins only at this stage. First, he must try to find those relations obtaining among the individuals and the classes by virtue of which the area considered has that unitary character that makes it a region. Second, he must identify the relations which obtain in this particular area as in-

stances of the causal interrelations that hold, by virtue of general laws among such features, individuals, classes, or what have you, in all known circumstances. This second step amounts, therefore, to an application of systematic geography to the area in question. Only after both these steps have been taken can one say that a scientific understanding of the region has been achieved.

This brings us to systematic geography. Its procedure is in principle not different from that of any other social or natural science which searches for laws or, what amounts to the same thing, has reached the systematic stage. Spatial relations among two or more selected classes of phenomena must be studied all over the earth's surface in order to obtain a generalization or law. Assume, for instance, that two phenomena are found to occur frequently at the same place. A hypothesis may then be formed to the effect that whenever members of the one class are found in a place, members of the other class will be found there also, under conditions specified by the hypothesis. To test any such hypothesis the geographer will need a larger number of cases and of variables than he could find in any one region. But if it is confirmed in a sufficient number of cases then the hypothesis becomes a law that may be utilized to "explain" situations not yet considered. The present conditions of the field indicate a stage of development, well known from other social sciences, which finds most geographers still busy with classifications rather than looking for laws. We know that classification is the first step in any kind of systematic work. But when the other steps, which naturally follow, are not taken, and classifications become the end of scientific investigation, then the field becomes sterile.

The present lack of clarity about the relative role and importance of regional and systematic geography can probably be traced to the preference given to either one or the other at various periods in the history of the field. For example: the physical geographer, being closer to the impact of the development of the natural sciences, felt at times the need for adequate tools specifically his own in the form of functions, rules, or laws. Physical geography had, therefore, a phase in the late nineteenth century when it concentrated on systematic work at the expense of regional studies. Some of these authors apparently felt that regional work, since it did not lead directly to the formulation of laws, was not worth doing and had better be abandoned. Thereafter, at the beginning of the century, largely as a reaction to this exclusive concentration on systematic studies on the part of the physical geographers, when the interest began to shift towards social or human geography, the social geographer scorned the fumbling systematic efforts which, in the absence of any adequate social sciences to draw upon, attempted to find the laws regulating the spatial aspects of social variables. Any generalization, clearly recognized as such, was considered empty and unpractical by these writers; regional descriptive geography appeared to them to be the only honorable occupation. To these men we owe the bulk of descriptive literature which, of course, contains much valuable material. Where they were actually better than their methodological creed they operated with insight or perhaps some sort of artistic feeling. In whatever methodological writing they did they aligned themselves with the opponents of scientific method.

All these confused controversies are still lingering on, so that even today hardly an article or book is free from them. Yet there is a small measure of progress. Hardly anybody maintains today that either the systematic or the regional emphasis is entirely useless and should, therefore, be abandoned. In its contemporary version the argument takes the form of the old hen and egg story, still debating the relative importance of systematic and regional work. Hettner thought that the core of geography was regional. Hartshorne believes that systematic geography is really indispensable to regional work; whoever likes it, or is by temperament fitted to pursue it, need not desert it; but the heart of geography is nevertheless regional. Just imagine a contemporary physicist maintaining that theoretical physics has its place and that its devotees should be left in peace, but that the real core of physics is experimental; or an economist who believes that only the study of a "regional" economy that actually exists now or existed in the past is economics proper, while the systematic part of economics, which formulates its laws, is merely esoteric by-play.

Neither Humboldt nor Ritter were plagued by these pseudo-issues. As they clearly saw, systematic geography attempts to formulate the rules and laws which are applied in regional geography. Humboldt felt that the formulation and testing of laws is the highest target a scientist could aim at. The systematic geographer, studying the spatial relations among a limited number of classes of phenomena, arrives by a process of abstraction at laws representing ideal or model situations; that is, situations which are artificial in that only a relatively small number of factors are causally operative in each of them. Practically, no single such law or even body of laws will fit any concrete situation completely. In this noncontroversial sense every region is, indeed, unique. Only, this is nothing peculiar to geography. As in all other fields the joint application of the laws available is the only way to exhibit and to explain what is the case. How much the known laws will explain and how complex a situation the scientist can tackle is a matter of degree, depending on the stage of development of the field. Ritter, one of the first modern geographers, had no systematic knowledge at his disposal. Conscious of this limitation, he kept regional geography, which was his primary interest, on a purely descriptive level. But he certainly made no virtue out of his choice and no methodological principle out of a practical limitation. Conversely, there is no need for regional geography to feel inferior to the systematic branch. For, systematic geography will always have to obtain its data from regional geography, just as the theoretical physicist has to rely on the laboratory for his. Furthermore, systematic geography receives a good deal of guidance as to what kind of laws it should look for from regional geography. For, again, regional geography is like the laboratory in which the theoretical physicist's generalizations must stand the test of use and truth. It seems fair to say, then, in conclusion, that regional and systematic geography are codign, inseparable, and equally indispensable aspects of the field.

One of the causes of the unnecessary argument between systematists and regionalists is, perhaps, purely psychological. Not every good theoretical physicist

would make a good experimentalist, and conversely. Generally, the ability to organize a field theoretically is not always associated with the proper interest and skill in collecting its data. Also, the application of laws to concrete situations demands a special aptitude. But there is no reason why such temperamental differences should be hypostatized into pseudomethodological positions.

Hettner, and even Kraft, speak of the two complementary emphases as founding a "dualism" which sets geography apart from all other disciplines. It should be already clear that there is, in fact, nothing unique or peculiar to geography in all this. If the term is meant to indicate opposition or conflict, then it is outright misleading. Yet, this so-called "dualism" has been cited in support of the claim that geography is a methodologically unique discipline. Nor is the complexity of the situation that faces the regional geographer in any sense out of the ordinary so that he would have a peculiarly difficult task of "integration," in another meaning of the glittering term. Quite to the contrary; he is at all fours with the other social scientists. When the economist applies his generalizations or laws to a given economic order, he deals not only with the complexity of the purely economic situation but takes account of the political, psychological, and social factors that influence it. This, after all, is the gist of so-called institutional economics. Similarly, a sociologist or anthropologist who analyzes a given primitive society, or a communist or agricultural one, deals with very complex situations. In the pretentious language of some geographers, such a sociologist "integrates" not only heterogeneous phenomena but, clearly, also heterogeneous laws. To say that the task of those social scientists is less complex, or less integrative than that of the geographer makes no sense. If anything, it is even more complex. For, the geographer's specific task in the analysis of a region is limited to spatial relations only. Accordingly, even the most complete geographical analysis of any region gives only partial insight into it. After the geographer is done there is still much work left before one understands fully the social structure of that region. Obviously; for, how could such an understanding be attained without even considering such factors as the ecology, economics, institutions, and mores of the region. In a manner of speaking, the geographer provides only the setting for the further studies of the other social scientists. It is, therefore, absurd to maintain that the geographers are distinguished among the scientists through the integration of heterogeneous phenomena which they achieve. There is nothing extraordinary about geography in that respect. One may conjecture that this notion is a hangover from the time when there were no social sciences and not much natural science, and when such quaint and encyclopedic endeavors as natural history and cosmology still occupied their place.

We have seen that there is a whole group of ideas which are variations of a common theme: geography is quite different from all the other sciences, methodologically unique, as it were. Influential and persistent as this position is in its several variations, it deserves a name of its own. I shall call it *exceptionalism*, and, for the moment, inquire into some of its historical roots.

II

The father of exceptionalism is Immanuel Kant. Though undoubtedly one of the great philosophers of the eighteenth century, Kant was a poor geographer when compared with his contemporaries or even Bernhard Varenius who died more than one hundred and fifty years before him. Kant made the exceptionalist claim not only for geography but also for history. According to him history and geography find themselves in an exceptional position different from that of the so-called systematic sciences. This grouping of geography with history has tempted many subsequent writers to elaborate the alleged similarity in order to obtain some insight into the nature of geography. This is undoubtedly one of the roots of the historicist variant of the claim to uniqueness with which we shall have to deal presently. But let us first inquire into what Kant himself said.

Kant taught a course in physical geography all through his teaching career, almost fifty times. The text of these lectures or, rather, class notes, was published in 1802, two years before his death.[6] It is in this work that one finds the statement on geography and history that has been quoted so reverently again and again by those who make it the cornerstone of geographical method. Ritter[7] used it; so did Hettner and, eventually Hartshorne. Humboldt, interestingly, neither quotes Kant nor shares his views. Neither does Kraft. But now for the words of the master:

> We can refer to our empirical perceptions either according to *conceptions* or according to *time and space* where they are actually found. The classification of perceptions according to concepts is the logical one, however, that according to time and space is the physical one. By the former we obtain a *system of nature,* such as that of Linnaeus, and by the latter a geographical description of nature.
>
> For example, if I say that cattle is included under the class of quadrupeds, or under the group of this class having cloven hooves, that is a classification that I make in my head, hence a logical classification. The system of nature is like a register of the whole; here I place each thing in its competent class even if they are found in different, widely separated places of the world.
>
> According to the physical classification, however, things are considered in their location on earth. The system of nature refers to their place in their class, but geographical description of nature shows where they are to be found on earth. Thus the lizard and the crocodile are basically the same animal. The crocodile is merely a tremendously large lizard. But they exist in different places. The crocodile lives in the Nile and the lizard on land, also in this country. In general, here we consider the scene of nature, the earth itself and the places in

[6] Immanuel Kant, *Physische Geographie.* Ed. F. T. Rink, Koenigsberg, 1802. In fairness to Kant it should be said that according to Adickes, the famous Kant scholar, the text as edited by Rink and used by Ritter, Hettenr, and Hartshorne is of doubtful authenticity. Four fifths of the manuscript is not in Kant's handwriting. It probably consists of notes taken by students during the very first semester in which Kant gave that course. Also, editing was done shortly before Kant's death when, as Adickes points out, he was too ill to make any alterations in what he had written or dictated in class before 1756. Quite apart from this, Erich Adickes in his book *Untersuchungen zu Kant's physischer Geographie* (Tuebingen, 1911) is rather distressed about the geographical ignorance displayed by his philosophical idol.

[7] Hartshorne, *op. cit.,* p. 136, maintains that Ritter "does not appear to have stated the comparison as clearly as either Kant or Humboldt."

which things are actually found, in contrast with the systems of nature where we inquire not about the place of birth but about the similarity of forms. . . .

History and geography both could be called, so to speak, a description, with the difference that the former is a description according to time while the latter a description according to space. Hence, history and geography increase our knowledge in respect to time and space. . . . Hence history differs from geography only in respect to time and space. The former is, as stated, a report of events which follow another in time. The other is a report of events which take place side by side in space. History is a narrative, geography is a description. . . .

Geography is a name for a description of nature and the whole world. Geography and history together fill up the entire area of our perception: geography that of space and history that of time.[8]

Kant's gigantic achievements in his own field as well as the influence which this unfortunate statement has had in ours require careful criticism, systematic as well as historical. Systematic criticism proceeds along two main lines. *First,* the distinction as intended is untenable in itself. It is simply not true that such systematic disciplines as, say, physics abstract from or otherwise neglect the spatio-temporal coordinates of the objects they study. One only needs to think of Newtonian astronomy to see immediately how wrongheaded this idea is. For what are the "systematic" laws of astronomy, such as Kepler's laws, if not a set of rules to compute from the positions of the heavenly bodies at any given moment their positions at any other moment? The error is really so obvious that one must immediately ask for a plausible cause. The answer, I suggest, is historical. When Kant wrote the passage in his youth he had probably not yet undergone the full impact of Newtonian science. Accordingly, he thinks of systematic lawfulness as essentially classificatory in the style of Aristotle and Linnaeus rather than of the process law variety of Newton. For the "precritical" Kant of 1756 this makes sense, at least biographically. But one may well doubt whether he would still have written this passage during his critical period, in his maturity during the seventies and eighties of the eighteenth century, after he had undergone the full impact of Newton and Hume. Into this period, however, fall the achievements on which his authority rests. How unfortunate, then, that so many geographers kowtow to a patently immature idea of his youth.

Second, we noticed that the resulting notion of geography is descriptive in the narrowest sense of the term. Obviously, it does not follow that there are no laws either of geography or of the socio-historical process simply because Kant thought that there were none. The facts have long proved him wrong. Historically, one can again understand how he came to hold such views around the middle of the eighteenth century. The social sciences were virtually nonexistent at that time. Their place was taken either by narrative history or by moral reflections or by a mixture of these two. The pioneer work of Bodin was forgotten; Macchiavelli was hated or refuted as a diabolic tempter; Montesquieu was more often praised than understood; the great contributions of Voltaire, Hume and Adam Smith were

[8] Immanuel Kant, *Physische Geographie.* Ed. F. T. Rink, Königsberg, 1802. Vol. I. pp. 6–8.

either still in the future or had not yet penetrated into the academic precincts of provincial Koenigsberg. (One look into Kant's *Moral Geography* or, as we would now say, comparative anthropology, suffices to convince one that it is as crudely and clumsily classificatory and enumerative as his *Physical Geography*.) The biological disciplines were at that time still largely classificatory or, as one says in this case, taxonomic. So it was not unnatural after all, that Kant in 1756 conceived of geography exclusively as a catalogue of the spatial arrangement and distribution of taxonomic features. What he formulated was therefore not so much the methodological schema of what we now call geography but, rather, in unusually abstract terms, the pattern of the then fashionable cosmologies whose literary history goes back to the Middle Ages. Humboldt's "Kosmos" is the last and, because of its stylistic merits, the most famous specimen of this literary genre. So it is forgotten that Humboldt himself in his other writings distinguished very well between cosmological description on the one hand and geography on the other. The literary charm of "Kosmos" has, unfortunately, overshadowed this fact. Yet, to judge Humboldt as a geographer by what he says in "Kosmos" is like judging Darwin's contribution to biology from the diary that he kept on the Beagle. For that matter, even in the introductory chapter of "Kosmos" Humboldt[9] patiently explained to the general public the difference between science and cosmology. All sciences, according to him, search for laws, or, as the later term goes, are nomothetic. Cosmology is *not* a rational science but at best thoughtful contemplation of the universe. Such contemplation has its place. Whatever else assumes the "pretentious name of a system of nature" is nothing but taxonomy, a mere catalogue of phenomena. Having delivered himself briefly of these fundamental observations, Humboldt, naturally enough in the introduction to his own cosmology, goes on to discuss the field of cosmology, only occasionally touching on geography. Cosmology is descriptive, something like an art. He advises it should not be studied without a good previous training in such systematic sciences as physics, astronomy, chemistry, anthropology, biology, geology, and *geography*. It is unfortunate that Hettner and, following him, Hartshorne, mistake this discussion for one of the methodology of geography. Humboldt is really not an authority properly cited in support of exceptionalism. One must not be misled by the circumstance that the great Kant in his day called geography what in Humboldt's terminology is *cosmology*.

One who is critical of the presentation just given may well ask why Humboldt, if he held such views, spent so much time, effort, and enthusiasm on cosmology. The question deserves an answer, which, in the nature of things, must again be historical. Humboldt lived at a time when a man of genius could still grasp and make significant contributions to virtually all the sciences. His own technical research was done in close personal cooperation with such founders of modern science as Gay-Lussac, Lalande, Arago, Thénard, Fourcroy, Biot, Laplace, Couvier, Gauss, and many others. Soon after Humboldt's time such versatility transcended human

[9] Alexander von Humboldt, *Kosmos. Entwurf einer physischen Weltbeschreibung.* Stuttgart, Tuebingen, 1845. Vol. I. p. 66.

strength for good. Humboldt's grasp, however, was still universal as well as technical, in the sense that he could keep up with the most specialized developments in many fields. A man of this caliber may well conceive of the idea of a great synopsis that could contribute to the intellectual enjoyment and enlightenment of a larger number of readers. A presentation or, as one would say today, a popularization of this kind would have to be descriptive rather than analytic. This may be submitted as the rationale behind Humboldt's enthusiasm for cosmology. In other words, he thought of his "Kosmos" as a piece of literature rather than a contribution to science. One more circumstance can be adduced in support of this view. Humboldt was, after all, a leader of the romantic movement, a contemporary of Herder and Schelling, and had in his youth embraced the pantheism of Goethe. Nothing is more characteristic of romanticism than the yearning for a synoptic view of the universe. Humboldt's *Kosmos* and his love for cosmology in general are therefore easily understood as his tribute to the romantic "Zeitgeist." *Kosmos* was indeed a great success throughout the world, also in this country. But from our point it is most important to see clearly that Humboldt, though he thought that cosmology had a legitimate place of its own, did not confuse it with what he clearly recognized as the science of geography. On the nature of the latter he did, therefore, not agree with Kant. The superficial appearance to the contrary is due to the fact that Humboldt treated history and cosmology as special disciplines outside of the sciences. Kant did make the same claim for history and geography. The point is that what Kant called geography Humboldt called more judiciously cosmology, at the same time emphasizing the scientific nature of geography proper.

III

Hettner's great prestige helped to perpetuate the confusion that has just been unraveled. Invoking the formidable authority of Kant, Hettner successfully impressed upon geography the exceptionalist claim in analogy to history. On this basic fallacy he built an elaborate argument. The principles of natural history or cosmology were forced upon geography. Spurious similarities between history and geography were constructed. Thus geography was laid open to the invasion of a whole host of nonscientific, not to say antiscientific ideas: the typically romantic argument from uniqueness; the hypostatization of the quite uncontroversial fact that variables must be expected to interact into an antianalytical holism; in connection with this the spurious claim for a specific integrating function of geography; and, finally, the appeal to the intuition and artistic touch of the investigator in preference to the sober objectivity of standard scientific method. Some at least of these points must now be taken up in detail.

Let us begin with a brief statement of Hettner's position in one of its two major aspects. Both history and geography are essentially chorological. History arranges phenomena in time, geography in space. Both, in contrast to the other disciplines, integrate phenomena heterogeneous among themselves. Also, these phenomena are unique. No historical event and historical period is like any other. In geog-

raphy no two phenomena and no two regions are alike. Thus both fields face the task of explaining the unique. Such explanation is, therefore, unlike all scientific explanation which "explains" by subsumption under laws. But there are no laws for the unique; little use, then, in looking for historical or geographical laws or prediction. The best one can hope for is, in Dilthey's fashion, some sort of "understanding" or, more frankly, empathetic understanding. An idiomatic difference between German and English has been instrumental in obscuring the basically anti-scientific bias of this doctrine. Hettner calls history "time-Wissenschaft" and geography "space-Wissenschaft." Hartshorne, as far as the dictionary goes quite correctly, translates this into "time science" and "space science." The point is that the German term Wissenschaft is much wider than the English "science" or, for that matter, the French "science." Wissenschaft for a German is *any* organized body of knowledge, not only what we call a science. Law is called Rechtswissenschaft; literary criticism or even numismatics, if cultivated with the proper Teutonic thoroughness and erudition may acquire the status of Wissenschaften in their own right. That much for Hettner's position and terminology. Now for criticism.

The use of the term history in methodological discussion is tantalizingly ambiguous. For the sake of precision it will here for the moment be given a very narrow meaning. History or historical research is the ascertainment of events that occurred in the past. Of course, not all past events are of equal interest to the historian. What he cares for are such phenomena as, say, the movement of the American frontier during the nineteenth century, or the reception of Roman law at the end of the Middle Ages. However, there is no need to begin with a methodological distinction between these and other past events. Historically significant facts are simply those which interest the historian in view of the patterns into which he hopes to arrange them. It should be granted without argument that the ascertaining of past events, even if they are not as elusive as the thought and motives of dead people, is by no means a simple matter. Quite to the contrary. Many sciences and also the most elaborate "scientific method" of inference from traces and relics to what they are the traces and relics of, must be put into the service of this most difficult undertaking of ascertaining the historical course of events. In this noncontroversial, auxiliary sense history certainly makes use of science and its methods. But what it thus achieves is nevertheless mere description and, in the nature of things, a very selective description at that. Science or, perhaps, Wissenschaft begins only when the historian is no longer an historian in the narrow sense and tries to fit his facts into a pattern. This, whether they know it or not, is what all historians try to do. What then, logically speaking, are they doing? At this point the argument begins. A baffling variety of analyses has been proposed. Basically there are two views, the scientific approach and historicism.

The scientific view, which is here taken, claims that all the data, which the historian in the narrow sense of the term collects, are nothing but raw material for the social scientist. The historian, in constructing his pattern is, therefore, whether he knows it or not, a social scientist. In other words, apart from all the technical

difficulties which were just mentioned, there is no difference in principle between a social scientist's use of the last census report on the one hand and his use of what historians have found out about the census variables in ancient Rome on the other. At this point, the terminological awkwardness of defining history as narrowly as it has been done for the sake of precision becomes obvious. For no worth-while "historian" will stop there. Assume, for instance, that he is interested in the market prices that prevailed in ancient Rome during a certain period. Naturally, he will first have to find out what they were. But then he will wish to go beyond that limited goal and try to find out how demand and supply interacted with each other and the other relevant social factors to produce those prices. The causal relations on which he draws for such "explanation" are *not* special historical laws but obviously, such as they are, the laws of economic theory. Similarly in all other instances. This is the point. With reference to geography, it follows that the historian who goes, as all historians do, beyond mere fact finding, is comparable to the regional geographer. In getting the facts the historian does what the regional geographer does in getting his. In trying to understand or, better, to explain them he does exactly what the regional geographer does in applying systematic geography to his region. In this broader sense of history, history is a science or, less ambiguously, history is social science applied to the conditions of a special "historical situation." Turned this way Hettner's analogy is acceptable. But then we have merely followed his words, not his meaning. What is this meaning? This brings us to the other view, historicism.

Historicism maintains that there is an alternative, radically different way of understanding the past or, for that matter, the present as a product of its past. The gist of it is the belief that by merely arranging the past events in their temporal order some sort of "meaningful" pattern, cyclic, progressive, or otherwise, will appear. To understand anything it is necessary and sufficient to know its history. Again, there is no argument if one takes that to mean that knowledge of the past state of a system *and of the laws of its development* leads to the knowledge of its present state. But what understanding can be gained merely from contemplating the successive stages of an unfolding process is hard to see. In other words, in the historicist interpretation the "genetic method" yields nothing.

For better or worse the antiscientific spirit of historicism was one of the major intellectual forces of the nineteenth century. Through Hettner it has penetrated geographical thought and, as we see it, powerfully affected its course. Characteristically, the very first sentence of Hettner's methodological work reads: "The present can always be understood only from the past." Also, his work on social and cultural geography exemplifies the genetic method applied to geography. And, as one would expect from a man of his breadth and vision, much of the material is not at all geographical but anthropological, cultural, or political.[10] To be sure,

[10] Alfred Hettner, *Vergleichende Länderkunde.* Vol. IV. Leipzig, Berlin, 1935; *Der Gang der Kultur über die Erde.* Leipzig, Berlin, 1929; *Das Europäische Russland.* Leipzig, Berlin, 1905.

that makes for good reading. But Humboldt's *Kosmos,* too, makes good reading; yet it is not geography. Among American geographers, Carl Sauer is perhaps the outstanding representative of historicism, building his geography consistently on Hettner's premise stated above.

The argument for the uniqueness of the geographical material stems both logically and historically from historicism. The main protagonist of this line of thought in America is Hartshorne. So it is easily understood why he makes so much of the old Kantian parallelism between history and geography. If history, according to the historicist, deals with unique events and if geography is like history, then geography, too, deals with the unique and must try to "understand" rather than search for laws. The formal syllogism is beyond reproach. To refute it one must, as we have tried to do, attack its premise. So let us first turn to the uniqueness argument as such and only then to the use Hartshorne makes of it.

The main difficulty of the uniqueness argument is that, as Max Weber has pointed out, it proves too much. Are there really two stones completely alike in all minute details of shape, color, and chemical composition? Yet, Galileo's law of falling bodies holds equally for both. Similarly, limited as our present psychological knowledge is, it seems safe to say that no two people would register identical scores on all tests as yet devised. Does it follow that our psychologists have so far discovered not a single law? What it all comes down to is a matter of degree. In the physical sciences we have succeeded in discovering a set of variables such that if two objects or situations, no matter how different they are in other respects, agree in these variables or indices, then their future with respect to these indices will be the same and predictable. To what extent and how soon any other field will reach a state as satisfactory as this is a matter of fact, to be decided by trial and error, not to be prejudged by pseudomethodological argument. Of course, the social sciences are not as well developed as physics. This is, indeed, what we mean when we call them less developed. On the other hand, it is also true that sciences which are less developed in this sense often resort with remarkable success to the search for statistical laws. Whether this kind of lawfulness is a measure of our temporary ignorance or must be taken as ultimate is a purely speculative point. Surely, the recent development in physics should give pause to anybody who attempts to deny on these grounds the logical unity of the sciences. To apply all this to geography, the claim is, then, that the difference between the differences between two "unique" regions on the one hand and the equally numerous differences between our two stones, on the other, is again a matter of degree.

There is still another misunderstanding that prevents some from fully appreciating this point. Stones do not really, as Galileo's formula tacitly assumes, fall in a vacuum. And they fall differently according to the characteristics of the medium through which they travel. Airplanes, by the way, do not fall at all in the ordinary course of events. Does that mean that Galileo's law is false; or that there are as many laws as there are atmospheric conditions; and still another set of laws for

airplanes? Obviously, this is not the way science operates. What scientists do is, rather, this. *They apply to each concrete situation jointly all the laws that involve the variables they have reason to believe are relevant.* The rules by which these laws are combined, thus reflecting what is loosely called the interaction of the variables, are themselves among the regularities science tries to discover. In fact, these are among the most powerful laws of nature and their very existence refutes the exaggerated claims of various brands of holism or gestaltism. There is thus no point in challenging, as Hartshorne does, the social scientist to produce a single law that would explain as complex a situation as the geography of New York Harbor. Descriptively the situation is indeed unique in the obvious sense that there has and will never be a region or location exactly like New York Harbor with all the services it supplies for its hinterland. Nor will there ever be any law to account for it. For, what point would there be in a law that takes care of one and one case only? But, on the other hand, urban geographers do by now know a few systematic principles which, jointly applied to New York Harbor, do explain quite a bit though not all of its structure and functions. This is the point. Or shall we give up the attempt to explain because we cannot as yet explain everything? In this respect geography finds itself once more in the same boat with all other social sciences. Or should we really reject sociology because the prediction of election results is not yet as reliable as some wish; or because we cannot tell for sure whether the Argentine will be a dictatorship or democracy five years hence? Such councils of despair are now heard again. Surely, they are merely a sign of the intellectual crisis of the age.

Hartshorne, like all vigorous thinkers, is quite consistent. He does, in fact, reject all social science and is particularly sceptical of the future of sociology. With respect to uniqueness he says that, "While this margin is present in every field of science, to greater or less extent, the degree to which phenomena are unique is not only greater in geography than in many other sciences, but the unique is of the very first practical importance."[11] Hence generalizations in the form of laws are useless, if not impossible, and any prediction in geography is of insignificant value.[12] Thus he comes after lengthy discussions to the same conclusion as Kant. "Both history and geography might be described as naive sciences, examining reality from a naive point of view, looking at things as they are actually arranged and related, in contrast to the more sophisticated but artificial procedure of the systematic sciences which take phenomena of particular kinds out of their real setting."[13] One may say that Hartshorne goes Kant even one better. For Kant geography is description; for Hartshorne it is "naive science" or, if we accept his meaning of science, naive description. As one would expect from all this, and as has been mentioned before, regional studies are for Hartshorne the heart of geog-

[11] Hartshorne, *op. cit.*, p. 432.
[12] *Ibid.*, p. 433.
[13] *Ibid.*, p. 373.

raphy. The terminology he uses stems in part from the German historicist philosopher Rickert who distinguishes between idiographic and nomothetic disciplines. The former describe the unique; the latter search for laws. Geography according to Hartshorne is essentially idiographic. Whenever laws are discovered or applied one is no longer in the area of geography. All it contributes is facts. "In its (geography's) naive examination of the interrelation of phenomena in the real world it discovers phenomena which the sophisticated academic view of the systematic sciences may not have observed, shows them to be worthy of study in themselves and thus adds to the field of the systematic studies."[14] In other words, Hartshorne takes permanently and systematically as narrow a view of geography as we have, temporarily and for the sake of the argument, taken of history.

Mainly through Hartshorne's efforts, American geographers have come to look at Hettner as the major recent authority in support of the idiographic conception of their field. Under these circumstances, it is important to point out that the picture Hartshorne paints of the German author is as one-sided as his quotations are selective. As has been hinted before, there is another side of Hettner's work. He could just as effectively be cited in support of the nomothetic position. Consider, for instance, the following excerpts from one of his earlier papers:

> Therefore, if we assume in geography the necessity of relations and, as in the natural sciences, exceptions in these only as apparent ones, as gaps in our knowledge, then with the frequent appearance of similar conditions we obtain the possibility of establishing anthropogeographical laws.
>
> We cannot say that similar conditions produce everywhere and always the same effects. Such a statement would ignore the fact that people differ and therefore can act differently under similar natural conditions. Also wrong, of course, would it be to say that similar people act alike under different natural conditions. Anthropogeographical laws have to take into account the difference in conditions of existence as well as the difference among people. Of course, in reality there will never be a repetition of exactly the same condition. Each situation is individual, unique, as a result of which no law will be able to explain the totality of a given phenomenon as in the natural sciences. There will always be a rest which must be explained under a different law or will remain unexplainable. . . .
>
> There are no absolute relations between man and environment which are valid for all time. With the development of mankind changes the nature of relationships between man and environment.
>
> *The development of these relationships rests on the constancy of effects although the causes which produced these effects may have disappeared some time ago.* (italics added)[15]

Nor was this an incidental remark that did not fit into Hettner's final thought. In his main work of 1927 one can still find passages like the following:

> As much as the individualizing method is appreciated and needed, one must say that geography received only through the generalizing method its stricter scientific character. Only the generic treatment which concentrated many properties and features into one word, made a concise and relatively short and easily conceived description possible. *Thereby it created*

[14] *Ibid.*, p. 461.

[15] Alfred Hettner, "Die Geographie des Menschen," *Geographische Zeitschrift*, Leipzig, 1907.

the basis for a more concise form of explanation resting on comparative investigation and leading to laws. In doing this, modern geography is far advanced over history. (italics added)[16]

One may agree or disagree with such passages which, as far as we know, have never before been translated into English. But one can hardly deny that, even taken by themselves, they amount to a programmatic declaration in favor of the conception of geography which is here advocated and which has been so vigorously opposed. Nor has this side of Hettner's thought been overlooked by all American geographers. Isaiah Bowman, for example, one of the pioneers of American geography, has declared that the search for laws and prediction based on laws is "the measure of a science."[17]

To emphasize this systematic side of Hettner is not to accuse Hartshorne of reading into him what is not there. Hettner undoubtedly advocated at different times and at different places the idiographic as well as the nomothetic conceptions of geography and, for all the complexity and subtlety of his thought, did not succeed in integrating them. This requires some comments, logical as well as historical. Logically, it must be noted again that there is in fact no conflict or opposition between the descriptive and systematic aspects of geography or, for that matter, of any other science, either physical or social. Difficulties arise only when the descriptive component is, in the German manner, rationalized into the idiographic method which is then conceived as coordinate with that of explanatory science. Historically, it seems plausible to say that the reason Hettner did not see this clearly is to be found in the preponderant historicism of his environment. The strength of historicism in German thought, academic or otherwise, ever since Hegel and up to the present is a matter of record. However, the German universities became during the same period one of the centers, perhaps the main center, of the rising natural sciences and, in connection with this, of what is sometimes called the positivistic philosophy of science, which stresses the search for laws and the methodological unity of all inquiry. These two philosophies have never been reconciled in the German mind. Nor is Hettner, and with him geography, the only victim of this sterile struggle. Perhaps the most tragic case, certainly the one with the most tragic and far-reaching consequences, is Karl Marx. There is no doubt that Marx made some historically important contributions to economics. In this respect he continued, characteristically, the work of the British classical economists, who thought of their field as a systematic discipline and were quite free from the Hegelian influence. Nor can it be denied that Marx's attempt to analyze the historical process, no matter how one-sided and biased his view of it may have been, represents a daring attempt to apply scientific thought to concrete situations. The his-

[16] Alfred Hettner, *Die Geographie, ihre Geschichte, ihr Wesen und ihre Methoden.* Breslau, 1927. pp. 222–223.

[17] Isaiah Bowman, "Commercial Geography as a Science. Reflections on some recent Books," *Geographical Review,* XV (1925): 285–294. See also his: *Geography in Relation to the Social Sciences.* Report of the Commission on the Social Studies, Part V, American Historical Association, New York, 1934.

toricist bias appears in Marx's conception of history as an "understandable" progression. From there it is but a small step to conceiving of history as a progress toward a desirable goal. In other words, history itself takes care of our aspirations. This is the basic teleology of historicism. Logically, this error is much more vitiating and, if you please, vicious than Marx's preoccupation with the economic variables.

IV

The impact of exceptionalism on geography has been profound. That is why it has been necessary to devote so much space to its refutation. Methodological discussion is indeed essentially dialectical in that much clarification is to be derived from the mutual criticism of contending viewpoints. Nor is such treatment as sterile and merely polemical as it might appear at first sight. Even so, with exceptionalism disposed of, we had now better turn to a group of more specific comments. There is, first, the general issue of pure versus applied science. Next, attention must be given to some of the difficulties geography shares with the other social sciences. Third, a few comments on geography's specific tools will be in order. Fourth, our dominant interest in structure, rather unlike that of the other social sciences, has certain logical aspects. They lead, fifth, to a re-examination of the idea of the region and, in connection with that, to the claims of holism. Sixth, comparative geography and typology must be recognized for what they are. Seventh, some recent claims of a more metaphysical nature in connection with the freedom of the will require that we understand clearly the much worried idea of geographical determinism. In conclusion, some remarks about the relations of geography to its sister disciplines now and in the foreseeable future will, perhaps, not be out of place.

Like others, we have occasionally spoken of applying the laws and concepts of systematic geography to the regional material. As a manner of speaking this is harmless enough. Yet it is false or, at least, misleading to oppose systematic and regional geography to each other as an instance of pure and applied science. The point is, very radically, that there is no such thing as a methodological distinction between pure and applied science. There is only science and science applied. Whatever distinction there is, is practical, a matter of either interest or emphasis. The laws for which the "pure" scientist looks are in no way different from those which he himself or his "applied" colleagues use. Conversely, some of the most important theoretical ideas have been suggested by engineering problems. To draw once more upon a field in which all these things have long been straightened out, engineering physics is not a branch of physics comparable with or coordinate to, say, thermodynamics or mechanics. Nor is, for that matter, the notion of application itself as unambiguous as one may think. It has at least two meanings. The regional geographer who explains some features of a region by the use of laws applies the latter in one sense of the term. The regional planner or soil conservationist applies the same laws in a different sense of application. He is a social engineer. The high prestige of and the justified concern with application in the sense of social en-

gineering is, for better or worse, one of the outstanding features of our civilization. The following syllogism needs, therefore, to be guarded against: applied science is the core of science; regional geography is applied science; hence, regional geography is the core of geography.

In order to clarify some logical points, repeated use has been made of physics, which is unquestionably the most highly developed of all sciences. To do this is not to deny that there are important differences among the various disciplines. But here, too, geography does not stand by itself in splendid isolation. It shares most of its methodological peculiarities with all other social sciences. Though this is not the place for an exhaustive treatment, some of these characteristics should be mentioned. The most serious difficulty, which all social sciences share, is the very limited scope or complete lack of experimentation. It is true enough, and has been frequently pointed out, that one cannot experiment in astronomy either; yet astronomy is the oldest, most precise and most successful natural science. But this is rather by way of the exception that confirms the rule. It just so happens that the celestial processes are periodical or very nearly so and depend on a very limited number of variables. For another difficulty, quantification, which permits us to draw upon the rich resources of mathematical inference, is not easily achieved in the social disciplines. In this respect geography and economics are, it would seem, somewhat better off than, say, political science and sociology. In the absence of easy experimentation and quantification the body of reasonably reliable laws in the social disciplines is not as impressive as in physics or, even, biology. It is only too true that social scientists, and geographers among them, are often still in the dark as to which variables are the relevant ones in any given situation. Naturally, for if we knew the variables, it would not be hard to guess at the law. And if we could experiment we would not need to guess. As has been pointed out once before, statistical techniques prove to be a powerful tool in making the best of the situation. Like all other social scientists, geographers have come to appreciate this tool. There are thus many important differences between the natural sciences and the social sciences. Logically, it is submitted, these are differences of degree, not kind. Whether, finally, the social sciences will ever be as perfect as the natural ones is a matter of fact. To assert that it must be possible for us to reach that stage would be dogmatic. But any assertion to the contrary is equally *a priori*. Upon examination it usually reveals itself as a romantic plea for such metaphysical ideas as the freedom of the will.

There is one major aspect in which geography does differ from the other social sciences. The latter, as they mature, concentrate more and more on the discovery of process laws, that is, to repeat, laws that are in one important aspect like the laws of Newtonian astronomy. Given the state of a system at a certain point in time, process laws allow for the prediction of the changes that will take place. Geography is essentially morphological. Purely geographical laws contain no reference to time and change. This is not to deny that the spatial structures we explore, are, like all structures anywhere, the result of processes. But the geographer, for most

part, deals with them as he finds them, ready made. (As far as physical geography is concerned, the long-term processes that produce them are part of the subject matter of geology.) Let us in this connection consider Koeppen's Hypothetical Continent. The word hypothetical merely indicates that he neglected, for the purpose of his climatological generalization, all but a few variables. For the remaining ones he states a spatial correlation that is a morphological law. To call such comparatively crude correlations patterns rather than laws is perhaps laudable modesty. But to think that patterns, in this sense of pattern, are different from laws, would be a mistake. This absence of the time factor within physical geography is the source of a peculiar phenomenon within all branches of human geography. The "social process" is, as the very term indicates, a process in the logical sense; and this process interacts with geographical factors. Assume for the sake of the argument two regions to be alike in all relevant physical aspects. They may, and as a rule will, differ with respect to some or all of the variables that interest the economic or social geographer. The reason for this is that the populations of the two regions went through different processes. Settlement patterns, for instance, may vary according to the state of technology at the time of occupation. What we are faced with in this case is not a failure of geography as a social science nor, as some would have it, with a breakdown of "causality." What we have uncovered is, rather, the exact point where the geographer must cooperate with all the other social scientists if they are jointly to produce more and more comprehensive explanations. Whether the geographer should stick to strictly morphological work which he can do by himself or, on the proper occasion, cooperate with the other social scientists is not a theoretical but a practical question to which we shall return at the end of the paper.

Technically, the morphological character of geography finds its expression in its own specific tool, maps and cartographic correlation. Mapping has been called the shorthand of geography. True as far as it goes, this clever simile fails to do justice to our technique in at least four respects. First, a map is not just a shorthand description but, in a quite literal sense, a picture exactly as a blueprint is a picture of a machine. For example, a map which preserves distance is in this respect a literal picture of the region mapped. It is, as logicians and mathematicians say, an isomorph of it. The techniques of geographical analysis are to a considerable extent based on such isomorphisms. Second, the pictures which we make by means of the various cartographic symbols are deliberately selective in two respects. We map only those features in which we are at the moment interested, and we neglect all the differences among the entities which we represent by the same symbols. One hardly needs to elaborate how useful it is to have such a convenient and selfregulating vehicle for the process of abstraction. Third, since maps are spatial isomorphs, they depict directly not only the various features which we try to correlate spatially, but also these correlations themselves. In other words, they serve the same function, or very nearly the same function, as charts, diagrams and other representations of functional connections. Much of what other social scientists achieve in this manner the geographer achieves by the technique of cartographical

correlation. By the single device of superimposing maps with isopleths such correspondences as, say, that between precipitation and crops can be discovered, at least in a preliminary and qualitative fashion, at a glance. This is more than just a different technique in the narrow sense of the word. It is a special tool of generalization and analysis used by no other science as much as by geography.

Cartographic correlation leads to two related topics, so-called comparative geography and typology. The term, comparative geography, is of old standing. Humboldt used it occasionally; Ritter and Hettner were quite fond of it. Both liked to "compare" very large and complex geographical phenomena, whole continents, or vast regions which, for all their complexities, exhibited some similarities. Now, the main point to be made here is that there is not, either in geography or elsewhere, any such thing as a comparative method as such. To put the same thing differently, the comparative approach is not a third alternative in addition to the descriptive and systematic one. Much of what goes on under the name of comparative geography is really systematic geography though, more often than not, of a rather rudimentary kind. Much other work that is called comparative is more or less naive regional description. Nor is it accidental that the most interesting attempts of this kind deal with large areas. If several such areas, differing in many respects as large areas naturally would, also show some marked similarities, it is, indeed, reasonable to consider these similarities as indicative of certain basic patterns. But then, we have seen before that to speak of such basic underlying patterns is but a covert way of referring to systematic lawfulness. Furthermore, while large scale comparisons may well yield valuable hints as to the underlying lawfulness, such intuitions must still pass the test of independent verification in further areas of all kinds and sizes. Logically speaking, comparative geography is, therefore, a half-way house between systematic work and regional description.

The same goes for typology. English and German geographers have not unsuccessfully tried to establish types of landschaft belts. Climatic regions, natural regions, wheat belts, coal mining regions are examples. Again it is not implausible that comparisons among the various specimens of such types will yield hunches. Exceptionalists will speak of the intuitive grasp of types, just as antiscientific psychologists speak of empathetic understanding of personality patterns. Advocates of the scientific method will recognize those hunches for what they are, educated guesses at systematic lawfulness. This is not to disparage this anticipatory stage. After all, science is educated guessing. But there is also no particular mystique about the notion of type. A type is just a class. An intelligent classification either anticipates or is based on some sort of lawfulness. If, therefore, the material itself suggests some sort of classification by mere inspection, one may hope to be on the track of some lawfulness.

If the notion of type is once clarified by being recognized as no more and no less than a fruitful classification, then the key to one of the most fundamental concepts of geography, the idea of the region, is also at hand. For, a region is defined conventionally as an area homogeneous with respect to one or two *classes of* phe-

nomena. As has been pointed out by Palander,[18] one of the keenest critics of economic geography, the notion of a region in itself explains therefore nothing. In particular, it is no substitute for the notion of a morphological or any other law. Rather, it enters into that notion. A morphological law is, in many cases, nothing but a statement of the lawful spatial relations within a region or between regions defined by different criteria. From a purely methodological standpoint this is really all that needs to be said about the notion of a region. This does not mean that we underestimate the role it plays in geography. The importance of a scientific concept is measured by its fruitfulness in application, not by how much can be said about it logically.

Regions and other geographical entities have been considered by many geographers as wholes in the sense of the doctrine of holism or gestaltism. A whole, in this peculiar doctrine, is more than the sum of its parts; also, it is unique in the sense that its various properties cannot be accounted for by applying standard scientific methods to its compound parts and the relations that obtain among them. Hartshorne, in arguing against such holists, is rightly opposed to the use of that doctrine in the definition of the geographical area and the region.[19] But after this rejection he finds it necessary to reintroduce the doctrine into geography when, later on, he defines cultural regions and, by the way of example, farm units as "primary wholes" the parts of which can be understood only in terms of the whole.[20] This is, indeed, different from "the merely analytic method of Hettner" says Passarge as quoted by Hartshorne. Now, the complete logical analysis of holism is an elaborate matter and cannot be taken up here in detail.[21] What it all comes down to is this. Whenever the one side insists that it has a whole, the other side claims that we simply do not as yet know enough to explain its behavior by standard scientific methods. In many crucial cases such explanation has actually come forth later on. One may, therefore, doubt whether there is such a thing as a whole in the holist's sense anywhere in nature. Within our field, the earlier discussion of the geography of New York Harbor is a case in point. Hartshorne who calls it unique, would consistently also have to call it a whole whose parts, like those of a farm unit, can only be understood from the whole. We, in turn, from our viewpoint, doubt whether any geographical entity, region or not, is a whole in this methodological sense.

Whoever rejects the scientific method in any area of nature, rejects in principle the possibility of prediction. In other words, he rejects what is also known as scientific determinism. The intellectual motif behind this attitude is in most cases some version of the metaphysical doctrine of free will. This may seem a far-fetched

[18] Tore Palander, *Beitraege zur Standortstheorie.* Dissertation, Upsala, 1935. pp. 17–20.

[19] Hartshorne, *op. cit.*, pp. 263–266.

[20] *Ibid.*, pp. 351.

[21] For a discussion of holism see: Gustav Bergmann, "Holism, Historicism, and Emergence," *Philosophy of Science,* XI (1944): 209–221. Also: "Theoretical Psychology," in *Annual Review of Psychology,* IV (1953), Stanford, by the same author.

allegation in a field like geography. A look at some recent publications[22] should suffice to allay any such doubt. Generally, the many interrelations between the various holisms, uniqueness doctrines, and free will philosphies are a matter of record.

If determinism is taken to mean that nature is lawful throughout, permitting of no "exceptions," then it is the common ground of all modern science. And if freedom of the will means that human decisions are not determined by their (physiological and/or socio-psychological) antecedents, then the will is indeed not free. At any rate, most scientists proceed on this assumption and are more than willing to leave the debate to the metaphysicians. However, the word determinism has still another meaning. Those, for instance, who blame Marx for his "economic determinism" do not need to reject the idea of universal lawfulness. What they reject is, rather, the doctrine that one who knows everything about the economic and technological conditions of a society, could in these terms alone predict its "superstructure" and its future development. Scientific determinism as such must therefore be carefully distinguished from the various determinisms with an adjective, such as economic determinism. These latter determinisms are specific scientific theories, to be accepted or rejected on the basis of the empirical evidence. Geography has been bedevilled by its own kind of determinism. Geographical determinism or environmentalism attributes to the geographical variables the same role in the social process as Marxism does to the economic ones. There is no good reason to believe that either of these two special determinisms is anything but a gross exaggeration of some admittedly valuable insights. There is nothing wrong with investigating the influence which the physical environment exercises, positively or as a limiting condition, on the social process. Most geographers would expect to find lawful connections in this area; that does not make them geographical determinists. Ratzel was the first to think originally and imaginatively along these lines. Like Marx, he was not quite as bad as some of his latter day disciples. In this country Semple was a student of Ratzel. In Ellsworth Huntington's writings geographical determinism reaches some of its dizziest heights. In France, Demolins insisted that if French history had to happen all over again it would essentially run the same course on account of the natural environment. The contemporary reaction against these exaggerations is understandably strong. But to fight them from the standpoint of science is one thing; to fight geographical determinism in order to fight science and its underlying idea of universal lawfulness is another thing.

We cannot and need not, as geographers, settle the future of science. But we may wonder what can reasonably be said about the future of geography as a discipline, an organized unit within the intricate division of intellectual labor. This is not strictly a methodological question and depends on many extraneous factors. Yet, it has a theoretical core that is not unrelated to methodology. So we shall

[22] Robert S. Platt, "Determinism in Geography," *Annals of the Association of American Geographers*, XXXVIII (1948): 126–132; and by the same author: "Environmentalism versus Geography," *American Journal of Sociology*, LIII (1948): 351–358.

venture a few remarks in conclusion. Science, to repeat once more, searches for laws. What then, one may ask, are the peculiarities of the laws we look for and which would make it advisable that they be kept together in one discipline? From this viewpoint, we believe, the laws of geography fall into three categories. Typical of the first are most of the laws of physical geography. These are not strictly geographical. Many of them are specializations of laws independently established in the physical sciences. These we take as we find them, apply them systematically to the various conditions that prevail on the surface of the earth and analyze them with particular attention to the spatial variables they contain. To be specific, the climatologist uses much physics (meteorology), the agricultural geographer, applied biology (agronomy).

Typical of the second category are many laws of economic geography, for instance, the now flourishing theory—for it has, indeed, reached the stage where one can speak of a theory in the strict sense of a whole group of deductively connected generalizations—of general location. As everybody knows, this theory investigates the spatial relations obtaining between the places at which the various economic factors, raw materials, producing units, means of communication, consumers, and so on, are to be found in any region. As far as they are morphological, these laws are genuinely geographic. The pioneer work in this area has, in fact, been done by economists, if we except Christaller who is a geographer.[23] But, as the theory is being refined, the geographer's skill will increasingly come into its own. For, he is more expert than others in the treatment of spatial factors and he knows from his rich store of experience with which others they typically interact. As far as these laws are not morphological, they belong to the third category.

This is a crucial point. We touched on it before when we used as an illustration two similar regions showing different settlement patterns because of the different processes their population had undergone. Let us try to state the case more generally. Mature social science looks for process laws. Knowing such laws one can ideally predict the whole course of history in a region, provided one also knows the influences that flow into it from without, if one knows its physical factors and the characteristics of the population that occupied it at a given time. Such laws are, of course, not geographical laws, nor do they belong entirely within any of the other now current divisions, such as anthropology or economics. The variables one must expect to occur in them extend over the whole range of systematic social science. Spatial variables are essentially and inevitably among them, but they are no more self-sufficient than those of economics or traditional sociology. It is our task to make explicit the role these geographical variables play in the social process. In other words, we must try to explore what else would be different in the future if, all other things being equal, the spatial arrangements in the present were different

[23] Johann Heinrich von Thünen, *Der isolierte Staat.* Rostock, 1842. August Lösch, *Die räumliche Ordnung der Wirtschaft.* Jena, 1940. Edgar M. Hoover, *The Location of Economic Activity.* New York, 1948. Walter Christaller, *Die zentralen Orte in Süddeutschland.* Jena, 1933.

from what they actually are. To insist on this is, as we saw, not geographical determinism. The real danger here is geographical isolationism. For, we have also seen that the search for these laws can only proceed in cooperation with the other social sciences.

What may one infer from all this for the future of geography? It seems to me that as long as geographers cultivate its systematic aspects, geography's prospects as a discipline of its own are good indeed. The laws of all the three categories which we have distinguished are no doubt both interesting and important. And they all contain spatial factors to an extent that requires special skills and makes the professional cultivation of these skills well worth while. We, the geographers, are these professionals. I am not so optimistic in case geography should reject the search for laws, exalt its regional aspects for its own sake and thus limit itself more and more to mere description. In this event the systematic geographer will have to move much closer and eventually attach himself to the systematic sciences.

REVIEWS AND ABSTRACTS OF STUDIES

URBAN GEOGRAPHY

The West European City. Robert E. Dickinson. London: Routledge and Kegan Paul Limited, 1951. 580 pp.

One of the major, though generally neglected, phases of urban geography is the analysis of the regional variations in the forms and functions of the cities of the world. Most urban geographers have studied individual cities in much detail, many have recognized the intimate relation of the structure of these cities to the larger cultural whole of which they are a part, but few geographers have taken the next step and attempted to characterize the cities of a world culture region. In attacking this important problem for Western Europe, Robert E. Dickinson has produced one of the most useful volumes of urban geography in the English language.

As Dickinson defines his purpose it is "to examine the physical structure of the urban habitat in Western Europe, North of the Alps and the Pyrenees, but excluding specific treatment of the British Isles. It is a morphological study, in which the form of the habitat is interpreted in the light of its function and historic development." His objective is carried forward in a two part study.

Part One begins with a chapter on the scope and method of urban geography. In Dickinson's view, geography, "as the study of area and regional association, is concerned in its human aspect with the areal differentiations of human activity and their imprint upon the earth's surface." The study of cities can be approached from various aspects. One of these is the comparative: "the size, function and form of settlement vary regionally with the development and present social and economic structure of the human groups which they represent and serve." The analysis of these features of cities which are "areally repetitive and significant," is, in part at least, the theme of the book.

The next dozen chapters consist of studies of individual cities, or groups of cities, drawn from the many published works available. Chapter 2, for example, is a fifteen page summary of Leighley's *The Towns of Mälardalen in Sweden.* Other chapters abstract material on the small historic town in France and the towns of Switzerland. Then follow twenty individual studies of the larger cities in Western Europe. Topics, such as location, site, development, functional zones, and distribution of population, are usually considered. A land use map of the functional zones of each city is included, as well as numerous smaller maps, aerial photographs, etc. There is a strong historical theme to these discussions and each contains much of value to students of European cities. Most of the material presented, is, of course not new. In fact, the selection of the cities to be discussed was frankly "governed by the availability of illustrative material." However, in this section material is brought together from numerous sources, originally appearing in a number of languages, in a readily available form.

It is perhaps Part II, which moves from the description of individual cities to a general analysis of European cities, that is the main contribution of the book. Here Dickinson is concerned with the origin of urban forms and functions in Europe, their development through varied periods in history, and their status in the Twentieth Century.

The West European city, in Dickinson's view, is the product of three stages of development: the Medieval; the Renaissance and Baroque; and the Modern. Since the vast majority of the cities and towns of Western Europe came into existence during the Medieval Period, this period is perhaps the most important of the three. The sites selected and street patterns laid out on the basis of Medieval requirements have left their imprint on the present city, and hence are considered in some detail. Various types of historic towns, differing in conditions of development, nature of activities, and degree of natural and planned development, are recognized and grouped into six regional families. In the next few chapters criteria are developed by which the "Medieval Gothic Cultural Sphere" (i.e. Western Europe) can be delineated. These include: use or function of buildings; arrangement of street, place, and open space; building heights; structure or form of buildings; and types of house.

The West European City is by no means a perfect book. One wonders, for example,

whether or not the same twenty cities would be discussed, and in the same way, if they had been chosen, not because they had been studied previously, but on the basis of what they could add to our understanding of European cities. One wonders too, exactly what there is about the author's style of writing that makes an interesting topic rather dull, and his thinking hard to follow. And one wonders most of all, why no summary chapter appears on the general characteristics of the cities of the "Medieval Gothic Cultural Sphere."

But the main usefulness of the book remains: it is a pioneering work on a significant topic, written by a mature scholar, who is thoroughly familiar with the literature of the area in question, and with a modern and acceptable philosophical viewpoint. It is a book which urban geographers and geographers interested in Europe will want to own. Finally, the usefulness of *The West European City* should act as a challenge to others to emulate Dickinson and attempt further to analyze the cities of the world's culture regions.

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THE PROBLEM OF FOOD AND HUNGER

The Geography of Hunger. Josué de Castro. Boston: Little, Brown and Company, 1952. xii and 337 pp.; bibliog.; index.

Dr. de Castro, Brazilian medical scholar and one of the leading figures in the United Nations' Food and Agriculture Organization, belongs to that small band of scientists concerned with the larger implications of human nutrition. During the past several years he has studied dietary phenomena in the American tropics and has inaugurated a series of erudite regional studies of nutrition (the first of which is his *Geografia da fome; a fome no Brasil,* Rio de Janeiro, 1946) intended ultimately to cover the major portion of the world. *The Geography of Hunger* is something of a digression from the larger project. Although his book is a premature and semi-journalistic synthesis of a badly slighted field of social science, de Castro has, nevertheless, given us a document that may well rank as one of the most meaningful of our times.

The intellectual audacity of this work is only partly reflected in a resumé of its subject matter. An intemperate introductory chapter belabors modern science for its failure to give the problem of food and hunger its proper due. The author ascribes this "conspiracy of silence" to selfish economic interest and to a misguided idealism in Western thought that overspiritualizes man. The picture is overdrawn, but, if de Castro can shatter the "taboo of hunger" as effectively as Freud destroyed scientific inhibitions about sex, his vehemence is excusable. Moreover, some of the energy currently being wasted in pursuing Freudian chimeras in social anthropology and psychology might be channeled more profitably into the study of the social effects of the more fundamental hunger drive.

After describing the whole "gamut of hunger" with particular attention to the less obvious "hidden hungers"—those chronic and specific dietary deficiencies that reduce the length and quality of human life far more seriously than outright starvation—the author proceeds in the longest section of this work to record the nutritional difficulties of the poorly fed populations of the world, region by region and with harrowing detail. Only Australia, New Zealand, southeastern South America, and part of Anglo-America are bypassed in a survey which can best be summarized in the statement that hunger, chronic and frequently acute, has been the lot of all except a favored fraction of humanity. Thus far there would seem to be little to distinguish the present work from the output of Vogt, Osborn, and Co. Actually, the author's hostility toward the neo-Malthusians is apparent from the first paragraph onward. His resentment against what he considers a dangerously misanthropic school of thought comes to head in the final chapters—"The Advance against Hunger" and "The Geography of Abundance"—in which the measures whereby hunger might be eradicated are set forth and the social and economic consequences of such a revolutionary event described.

The Geography of Hunger is the first book-length attempt to describe the world geography of diet. The fact that it contains many minor factual inaccuracies and some questionable statements on regions and scientific disciplines beyond the author's personal ken is an indication of the heroic dimensions of his task. There will surely be better geographies of diet in the future, but none braver. There is every reason for hoping that de Castro's work—though it may contain more hunger than

geography—will inspire activity within the geographic fold, where Max Sorre has been waging an almost single-handed campaign for dietary research (see his "La geographie de l'alimentation," *Annales de Géographie*, LXI: 184–99, May–June, 1952), as well as among other social scientists.

The more immediate value of *The Geography of Hunger* is the contribution to population theory and philosophy which is woven into all its chapters. De Castro has set out to demolish neo-Malthusian doctrine with great passion and skill. The force of his argument, which is beyond the shallow optimism of most anti-Malthusians, is so persuasive to the uncommitted reader that he would seem to have gained the advantage for the moment. His peroration on the subject is worth quoting:

> "The road to world survival, therefore, does not lie in the neo-Malthusian prescriptions to eliminate surplus people, nor in birth control, but in the effort to make everybody on the face of the earth productive. Hunger and misery are not caused by the presence of too many people in the world, but rather by having few to produce and many to feed. The neo-Malthusian doctrine of a dehumanized economy which preaches that the weak and the sick should be left to die, which would help the starving to die more quickly, and which even goes to the extreme of suggesting that medical and sanitary resources should not be made available to the more miserable populations—such policies merely reflect the mean and egotistical sentiments of people living well, terrified by the disquieting presence of those who are living badly." (p. 312)

The central thesis of the book is a simple yet major idea: hunger is man-made, not the result of the stinginess of nature, but rather of "grave errors and defects of social organization" and, furthermore, ***hunger is actually the cause of overpopulation, not its product.*** Some major ideas are corollary to this notion: notably the fallacy of speaking of "surplus" population and the fact that population limitation is no palliative since it treats the symptoms and not the cause. An incidental suggestion worth the attention of physical anthropologists is that many of the morphological differences among races commonly supposed to be hereditary may actually be the temporary result of dietary conditioning. De Castro is scholar enough to realize how old and complex is the social malfunctioning responsible for malnutrition, but he is prone to oversimplify the situation by occasionally picturing aboriginal cultures as well-nourished and modern European imperialism as the single great corrupter of the world's pantry. Be that as it may, the startling idea that hunger is the cause of overpopulation is supported with much vigor: many societies trying to subsist from an artificially constricted resource base are constantly needful of more hands to wrest additional calories from the earth; "the psychological effect of chronic hunger is to make sex important enough to compensate emotionally for the shrunken nutritional appetite;" and—the most novel suggestion of all—there may be an inverse relationship between the level of human fecundity and of protein intake. Since the physiology of human fertility is a long way from being fully understood and since the contention that protein consumption may be a demographic factor is highly debatable, it is unfortunate that an issue has been raised which may cloud the very real merits of de Castro's argument.

Actually, as Lord Boyd-Orr wisely notes in his introduction to the volume, the social and economic factors controlling fertility are of fearsome complexity—and, it should be added, more crucial than the purely physiological factors. We can accept the de Castro thesis as part of the more general proposition that low living standards are associated with a pattern of high fertility and that the answer to the world's woes is not fewer people, but the better distribution of a larger amount of goods. Engrossed as he is in his scientific specialty and in the crusade against neo-Malthusianism, de Castro has lost sight of some of the main issues in demography. In the light of existing statistics, it is impossible to support the idea that notable population increases have occurred within historic times as the result of a positive rise in fertility. Rather it has been a decided drop in mortality that has caused the explosive growth of world population during the past three or four centuries, especially in those areas where, because of low living standards or other reasons, birth rates have been slow to decline.

If Dr. de Castro's diagnosis is defective, his prescription for overpopulation would, nevertheless, seem quite valid. His program makes particular sense in regions such as the American South where there is an obvious

disproportion between a socially induced "overpopulation" and an immense amount of unexploited or misdirected natural wealth. De Castro does not quaver even when confronted with such demographic chambers of horrors as Puerto Rico, San Salvador, or the deltaic regions of Monsoon Asia. The details of this program are simple in outline, but enormously difficult of execution. The extension of cultivated area and the application of advanced scientific technology to food production raises serious economic questions, and the elimination of colonialism and a re-alignment of governmental policies to ensure an equitable division of foodstuffs is a process whose political mechanics stagger the imagination. The author does not minimize these difficulties; he is not cheerful about the present situation or the immediate future, but he is irrevocably convinced of the inevitability of an era of abundance, however painful may be the transition from the epoch of "economic man" to that of "social man" through which we are now beginning to pass. It is worth pointing out, finally, that for all its shortcomings this volume is an inspiring example of what, for lack of a better term, must be called scientific humanism, the doctrine that science is meant to serve the needs of a mankind capable not only of overcoming the hazards of the physical universe but also such man-made catastrophies as poverty and hunger.

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